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DESIGN CONSIDERATIONS AND CRITERIA FOR A MANAGEMENT INFORMATION--ETC(U)

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# NAVAL POSTGRADUATE SCHOOL

## Monterey, California

# THESIS

DESIGN CONSIDERATIONS AND CRITERIA
FOR A
MANAGEMENT INFORMATION AND CONTROL SYSTEM
FOR THE
SIDEWINDER PROGRAM OFFICE
NAVAL WEAPONS CENTER, CHINA LAKE, CALIFORNIA

by

John Franklin McClain III
and
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March 1977

Thesis Advisor: LCDR E. A. Zabrycki

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This thesis examines the requirement for a Management Information and Control System (MICS) by the Sidewinder Program Office at the Naval Weapons Center (NWC), China Lake, California. Specifically, it examines the need and criteria for a MICS to adequately fulfill the control and planning aspects of the program management process at the Sidewinder Program Office at NWC (SPO/NWC). The thesis discusses the considerations and criteria appropriate for a viable

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MICS in general application and examines the existing SPO/NWC environment and MICS. Roles, responsibilities, information flows, and controls with respect to the SPO/NWC are identified. The authors stipulate the information and control requirements necessary to ensure successful SPO/NWC accomplishment of responsibilities and evaluate the current system in light of these requirements. The current system is found to be inadequate and the authors present a conceptual model of a MICS for the SPO/NWC which would provide the planning and control capabilities required.

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# Design Considerations and Criteria for a Management Information and Control System for the Sidewinder Program Office at the Naval Weapons Center China Lake

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ABSTRACT

(specifically, the needs and criteria

This thesis examines the requirements for a Management Information and Control System (MICS) by the Sidewinder Program Office at the Naval Weapons Center (NWC), China Lake, California. Specifically, it examines the need and criteria for a MICS to adequately fulfill the control and planning aspects of the program management process at the Sidewinder Program Office at NWC (SPO/NWC). The authors ~~thesis~~ discuss~~es~~ the considerations and criteria appropriate for a viable MICS in general application and examine~~s~~ the existing SPO/NWC environment and MICS. Roles, responsibilities, information flows, and controls with respect to the SPO/NWC are identified. The authors stipulate the information and control requirements necessary to ensure successful SPO/NWC accomplishment of responsibilities and evaluate the current system in light of these requirements. The conclude that the current system is is found to be inadequate. ~~and~~ They ~~authors~~ present a conceptual model of a MICS ~~for the SPO/NWC~~ which would provide the planning and control capabilities required.

TABLE OF CONTENTS

# I. INTRODUCTION

## A. BACKGROUND

### 1. The Matrix Organization and Program Manager Concept.

Project management is the central organizational device for integrating the effort required to develop weapons systems within the Department of the Navy. The primary characteristic of project management is organization by purpose and output in contrast to organization around functions, skills or disciplines as found elsewhere in government and in industry. Both types of organizations are used in Navy Weapon Systems Acquisition and are essential to effective and economical weapon systems development and procurement. The functional organization is superior for advancing the state of the art. It brings together the skills, equipment and physical facilities required for effective performance. The project management concept of organization by purpose is necessary for the coordination and integration of the output of the functional organization in order to insure that desired program purposes are accomplished.

### 2. Management Control and Information.

Management control over all aspects of the project is delegated to the Program Manager in the program charter issued by the cognizant authority and is vital to the

efficient and effective functioning of a Program Office. Having the authority for program control and actually achieving effective program control is, particularly within a matrix configuration, another matter. Since he does not have line authority over individuals outside the Program Office, the Program Manager's task is one of exercising tact, diplomacy and leadership in enlisting the cooperation of both seniors and subordinates in the functional organizations that actually provide the support for the program.

The degree of management control and its effectiveness is directly proportional to the information flow to and from the program office. Information exchanges upward, downward and laterally must be established and nurtured. The outward information flow provides the guidelines to accomplish the goals of the program office. In order for this tool to be effective, however, information must be fed back to the program office. This is the information used in management appraisal - assessing the effectiveness of existing policies, developing and evaluating policy changes, measuring progress, replanning, rescheduling and all the other activities necessary in accomplishing objectives and utilizing government and contractor resources to the fullest extent possible. The existence of this "closed-loop" characteristic in the information flow is essential for successful program management.

An effective "directive and reporting" system, while an important aspect of communication, will not suffice for an information system in program management. The preparation time alone for such documents obviates their use in real-time program management. A successful program office will utilize a combination of communication methods - letter, message, telephone, telecopier, film, conferences, etc. Building an information network and maintaining its effectiveness is essential to the successful accomplishment of the primary tasks of the Program Manager.

3. Sidewinder Program Management.

a. Organizational Relationships

Project management in the Naval Air Systems Command (NAVAIR) cuts across the functional organization under the Chief of Naval Material (CNM) and serves as a single point of contact and effort to get the job done. Project managers operate under charters issued by CNM or by the Commander of a Systems Command. NAVAIR has cognizance for the Sidewinder missile and the Infrared Missiles Program Manager (PMA-259), is chartered by and reports directly to the Commander of the Naval Air Systems Command. The project charter prescribes the scope of authority, responsibility and operating relationships of PMA-259.

The Sidewinder Program Office at the Naval Weapons Center (SPO/NWC) at China Lake, is also organized around a project management matrix concept. The project management approach is used to provide an integrated, single

point-of-contact at the Naval Weapons Center (NWC) and maintain the emphasis on output required to bring a new weapon into operational service. The SPO/NWC provides this interface and point-of-contact between NWC and other DoD and/or civilian activities. The SPO/NWC is also the interface for the program to the functional codes within NWC which actually provide the services and accomplish the tasks required.

The SPO/NWC is administratively located in the Engineering Design Division of the Engineering Department. The SPO/NWC tasks and funds continuing efforts in several divisions/departments throughout NWC. Other branches are intermittently tasked to support the analysis, design, testing, and evaluation functions necessary to put the Sidewinder missile system into Navy and Air Force arsenals.

b. Role and Responsibility of SPO/NWC

NWC is tasked with the responsibility for the technical support of the Sidewinder missile (AIM-9) systems by NAVAIR. This technical support task is comprised of production support, development, testing, and Integrated Logistics Support (ILS) functions. In order to accomplish these fundamental functions, tremendous coordination is required between NWC and NAVAIR, Participating Field Activities (PFAs), co-sponsoring Air Force activities, and primary and secondary source contractors for AIM-9 hardware and software. In addition, the coordination of tasks distributed among the NWC functional codes must be accomplished.

SPO/NWC provides the coordination required in both these areas.

Overall responsibility for tasking and funding commitments are received by the SPO/NWC in the form of AIRTASK and Work Unit Assignment documents from NAVAIR and Project Orders from other Navy and Air Force field activities. The SPO/NWC release-to-work documents are Task Agreements to the NWC supporting codes, Project Orders to other field activities and contracts to civilian industry.

c. The Management Information and Control Problem Within SPO/NWC

The myriad of technical, operational, financial and administrative details involved in managing the AIM-9 program at NWC, are handled by the twelve individuals in the SPO/NWC, and many others throughout the NWC supporting codes. These individuals each maintain personal files and records; however, no single file or set of files aggregates or integrates the information contained in these files. Much of the information flow is verbal, or in informal notes and memoranda from many different sources and on many diverse subjects, which is not captured in any formal file for use by the Program Manager. The present loss of information through inaccessibility (travel, leave, etc.) of key individuals and lack of proper documentation results in considerable time being consumed in data searches

and duplication of effort. The combination of these situations results in a lack of overall visibility into total organizational workload for planning purposes and insufficient control of progress in accomplishment of assigned tasks.

## B. THESIS HYPOTHESIS AND OBJECTIVES

### 1. Hypothesis.

The hypothesis of this thesis is that the Program Manager concept and utilization of the matrix organization technique for program management accentuates the need for a comprehensive and timely management control system within the context of a program management information system (MIS). In particular, the SPO/NWC Manager has a definite requirement for a comprehensive, responsive management information and control system (MICS) to enable him to properly perform the multitude of tasks required of his organization. The authors believe that the current control system employed at the SPO/NWC is not adequate to fulfill the need. It requires an inordinate amount of managerial time to monitor task completion and the system is not comprehensive enough to insure that all tasks are monitored. In addition, it does not provide adequate visibility to allow for proper program planning and allocation of resources. It is further believed that an improved system would be less time consuming and provide information for successful program planning and control.

### 2. Objectives

The objectives of this thesis are: 1) to identify and discuss the criteria and considerations appropriate for a viable MICS, 2) to examine the existing SPO/NWC environment and MICS to identify roles, responsibilities, information flow and controls, 3) to stipulate the information and control requirements deemed necessary by the authors to insure successful SPO/NWC control, 4) to evaluate the current MICS and ascertain the need for improvement, and 5) to recommend a MICS framework for subsequent system design and implementation.

## C. METHODOLOGY

### 1. Process and Scope

The development of MISs has evolved into a process much the same as the weapon system acquisition process. Current literature calls for a project manager concept employing "user-producer" (management-designer) dialog, and delineates a system life cycle approach. Although the descriptions of this system life cycle range in the literature from those with four phases to one model with twelve phases, the concepts are the same. The system passes through various stages in development from inception to full utilization.

One such model of the systems' life cycle was presented by J. T. Rigo[1] and portrayed an eight-phase development. The eight phases are depicted in Table I-A. This thesis will encompass the first three phases in the

| PHASE | EVENTS/TASKS |
|---|---|
| Initiation | Statement of the Problem<br>Statement of Objectives<br>Statement of Anticipated Benefits |
| Survey | Documentation of Current Situation |
| Requirements | Stipulation of User Requirements<br>-outputs<br>Identification of Alternative Gross Designs<br>-inputs, outputs, processing |
| Preliminary Design | Selection of a Gross Design Alternative<br>Preparation of Functional Specifications<br>Cost/Benefit Analysis |
| Detail Design | Preparation of System and Programming Specifications<br>Plans for Training, Forms and Manual Preparation |
| Development | Programs Written<br>Hardware Procured<br>Forms and Procedures Designed |
| Implementation | System Tested in Parallel with Existing System<br>Operational Acceptance |
| Evaluation | Cost and Performance Evaluated<br>Modifications Implemented as Required |

INFORMATION SYSTEM DEVELOPMENT STRUCTURE[1]

TABLE I-A

process and the selection of a gross design alternative. It is felt that this is the extent of the effort which can be accomplished within the time constraints imposed and the level of technical expertise of the authors.

Another limitation of the scope of the thesis is in the area of the SPO/NWC functions. As indicated previously, the SPO/NWC has the responsibility for all technical support of the Sidewinder missile system. While the problems and objectives described earlier are applicable to the total SPO/NWC operation, this thesis will concentrate only on the AIM-9L Production Support functions in its analysis. This limitation is self-imposed in order to reduce the research effort to a level commensurate with time restrictions. It is felt that this limitation is not detrimental to the overall effort in that AIM-9L Production Support represents about forty percent of the SPO/NWC workload and is representative of the remaining efforts in terms of management planning and control.

2. Personal Contact

Information for this thesis has been gathered largely through personal contact with key members of the SPO/NWC. One of the authors is the Program Manager of the SPO/NWC and the other author made a total of five visits to NWC over a period of nearly six months. During these visits, management information and control aspects of the program were discussed in depth, and pertinent technical features were reviewed with key personnel.

3. Review of Current Literature

Basic research was conducted in order to gain knowledge and appreciation in the areas of management control and planning and management information systems. This was accomplished by reviewing current periodicals, books, and reports. The more pertinent of the material reviewed is listed in the Bibliography.

4. Analysis

Decision level analysis and information flow analysis were both employed in the evaluation of the facts for this thesis. Techniques used in these analyses included organizational charting and information and systems flow charting. Input and output volume and frequency data were collected by total item count over a designated period.

## D. THESIS ORGANIZATION

This thesis is organized to coincide with and achieve the thesis objectives previously outlined. Chapter II is a survey of the literature search in the areas of planning and control and MIS, and includes the design considerations and criteria currently held by various authors as appropriate to the MICS development process. It presents two conceptual frameworks within which to view a MICS and the implications of those frameworks upon the MICS in the areas of information requirements, system characteristics, and the system design process. The chapter concludes with a discussion of

criteria for selection of a MICS type for a specific application. Readers familiar with MICS concepts and capabilities need not read this chapter.

Chapter III examines the existing SPO/NWC environment and MICS. It explores the organizational relationships of those activities which interact with the SPO/NWC in the Sidewinder Program, and the roles, responsibilities, and information flows associated with these relationships. Also delineated in this chapter are the processes of task assignment within these relationships and the current SPO/NWC systems utilized for planning and control purposes. This chapter represents the Survey Phase of the Rigo MICS development model previously outlined.

The establishment of the information and control requirements necessary to ensure successful SPO/NWC operation are outlined in Chapter IV. First, general goals and objectives for a viable SPO/NWC MICS are presented and the current information and control systems are evaluated in light of those goals and objectives. Secondly, a conceptual model for an appropriate SPO/NWC MICS is presented. Thirdly, the proposed conceptual model is further defined in terms of more specific system outputs, data processing required, and data inputs required. Chapter IV is an application of the Rigo Requirements Phase to SPO/NWC.

Finally, Chapter V presents a brief summary of the thesis to that point and outlines the conclusions and recommendations of the authors.

## II. MANAGEMENT INFORMATION AND CONTROL SYSTEMS DESIGN CONSIDERATIONS AND CRITERIA

### A. BACKGROUND

A comprehensive search of current literature was undertaken to determine if a model for the design of management information and control systems existed. For this thesis, the term "model" is defined as a set of formulae or considerations which when entered with appropriate data would result in a specific MICS design. No such model was found. What was discovered was a recurring description of the process of MICS development as briefly outlined in the methodology and the stipulation of certain information characteristics and classifications and system characteristics which when analyzed in the light of user requirements and constraints would yield the general design of the appropriate MICS for the desired application. Of note is the fact that virtually all the literature encountered dealt with the private sector and as such emphasized the goals of the business enterprise and interactions with the market place. This orientation made it difficult to apply all the principles expressed to the Government perspective.

The role of the SPO/NWC Manager was described briefly in Chapter I as one of performing the management functions of planning and controlling to assure the attainment of program goals and objectives. It was hypothesized that a comprehensive "system" was required in order to adequately

perform this role. A "system" is defined in Webster's Unabridged as "a complex unit formed of many often diverse parts subject to a common plan <u>or serving a common purpose</u>." It would appear obvious then that to design a system to serve a purpose, a concise definition of the purpose is essential. A concise definition of planning and control has been the center of arguments among authors of management texts for years. Particularly useful definitions of the planning and control functions for use in information systems design, however, are expressed by Robert Anthony and G. A. Gorry and M. S. Scott-Morton.

## B. CONCEPTUAL FRAMEWORKS FOR MICS

### 1. Robert Anthony Framework for MICS

In *Planning and Control Systems: A Framework for Analysis*, Anthony addressed the problem of developing a classification scheme that would allow management some perspective when dealing in the area of planning and control systems. He developed a framework for analyzing these managerial functions or processes consisting of three categories and argued that the differences among these categories were so significant that the systems designed for the processes would have substantially different characteristics.

The first of Anthony's categories of managerial activities is "strategic planning." Strategic planning is defined as "the process of deciding on objectives of the

organization, on changes in these objectives, on the resources used to obtain these objectives, and on the policies that are to govern the acquisition, use and disposition of these resources."[2] Anthony made a number of points with respect to strategic planning. First, it focuses on the choice of objectives for the organization and on the means required to achieve these objectives. As a result, problems in this area tend to involve longer range planning and therefore require prediction as to the future of both the organization and its environment. Secondly, the strategic planning process usually involves a small number of high-level people who must operate in a nonrepetitive and often very creative way. Thirdly, the types of decisions to be made involve many variables, and are usually unstructured and irregular. The results of these decisions are policies and precedents which are extremely difficult to evaluate.

The second category defined by Anthony is management control. This process was defined as "... the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives."[2] He stresses three key aspects of this function. First, the process involves a larger number of persons; managers who must accomplish their tasks through interpersonal relations. Secondly, these tasks are defined within the context of objectives and policies that have been determined in the strategic planning process. Thirdly, the relevant criteria for evaluating the

actions taken are effectiveness and efficiency.

Anthony's third category is operational control which he defines as "the process of assuming that specific tasks are carried out effectively and efficiently."[2] The basic distinction between management control and operational control is that operational control is concerned with the execution of specified tasks, whereas management control deals with the whole stream of on-going activities rather than on specific tasks. Just as management control operates within policies established by strategic planning, so operational control occurs within a set of procedures and rules that are derived from both management control and strategic planning.

Anthony pointed out that the boundaries between these three categories are often not clear. In spite of their limitations and uncertainties, however, these categories are useful in the analysis and design of information systems.

### 2. Gorry and Scott-Morton Framework

G. Anthony Gorry and Michael S. Scott-Morton have also addressed the area of a conceptual framework for MIS. In a paper published in the Sloan Management Review (Fall 1971) they state that the purpose of their work is "... to present a framework that helps us to understand the evolution of MIS activities within organizations ... this framework is designed to be useful in planning for information

systems activities within an organization and for distinguishing between the various model building activities, models, computer systems and so forth which are used for supporting different kinds of decisions."[3]

The Gorry and Scott-Morton framework is a two-dimensional framework which integrates the managerial functions as defined by Anthony with decision types as defined by H. A. Simon. In the New Science of Management Decision, Simon is concerned with the manner in which people solve problems regardless of their position within the organization. He makes the distinction between "programmed" and "nonprogrammed" decisions. Programmed decisions are defined as those which are repetitive and routine to the extent that a definite procedure has been established for handling them each and every time they occur. Nonprogrammed decisions are those for which no "automatic" method for the decision making process has been established. They are by nature novel and nonrepetitive and therefore require individual action based on intelligent, adaptive problem solving.

Gorry and Scott-Morton chose to use the terms "structured" and "unstructured" in lieu of programmed and unprogrammed in order to stress the basic concept of the problem-solving activity in question and avoid the implication of computer dependence which might result from the use of Simon's terminology. They also included a class of decisions which they called "semi-structured." These decisions are characterized by the ability to structure a

portion of the decision making process but not the process in its entirety.

| | OPERATIONAL CONTROL | MANAGEMENT CONTROL | STRATEGIC PLANNING |
|---|---|---|---|
| STRUCTURED | ACCOUNTS RECEIVABLE<br>ORDER ENTRY<br>INVENTORY CONTROL | BUDGET ANALYSIS— ENGINEERED COSTS<br>SHORT-TERM FORECASTING | TANKER FLEET MIX<br>WAREHOUSE AND FACTORY LOCATION |
| SEMISTRUCTURED | PRODUCTION SCHEDULING<br>CASH MANAGEMENT | VARIANCE ANALYSIS— OVERALL BUDGET<br>BUDGET PREPARATION | MERGERS AND ACQUISITIONS<br>NEW PRODUCT PLANNING |
| UNSTRUCTURED | PERT/COST SYSTEMS | SALES AND PRODUCTION | R&D PLANNING |

GORRY AND SCOTT–MORTON INFORMATION SYSTEMS FRAMEWORK (3)

FIGURE II-1.

A pictorial representation of the Gorry and Scott-Morton framework is presented in Figure II-1. While some examples are listed in each of the six cells, it is emphasized that the cells are not well defined categories just as with the Anthony framework. The Gorry and Scott-Morton framework merges the two different perspectives of managerial activity taken by Anthony and Simon. Anthony's categorization is based on the purpose of the management activity, while Simon's classification is based on the manner in which the manager deals with the problems which confront him. The combination of these two views provides a useful framework within which to examine the purposes and characteristics of information systems.

## C. FRAMEWORK IMPLICATIONS ON THE MICS

The characteristics of managerial activity defined by the Anthony and the Gorry and Scott-Morton frameworks have explicit implications on information systems design in three general areas: information requirements, system characteristics, and the system design process. Implications in all three of these areas will be addressed here; however, only the information requirements considerations will be addressed in detail. The remaining two areas will be discussed at greater length in subsequent sections of this chapter.

### 1. Information Requirements

Clearly, there are many choices with regard to the characteristics of information presented to a decision maker or manager. The system designer must consider the use to which the information will be placed in deciding what information to provide. If the information requirements of the three categories presented by Anthony are considered, it can be seen that they are very different from one another. Further, this difference is not simply a matter of aggregation from one level to the next but one of fundamental difference in the characteristics of the information needed by the managers in these areas.

Strategic planning deals with broad policies and organizational objectives. Consequently, the relationship of the organization to its environment is a matter for consideration. Also, the nature of the activity is such that predictions of the future are required. Therefore, the

information needed by strategic planners is generally information from outside the organization and is based on estimates. It follows that this information is relatively imprecise and of an aggregate nature. Also, the nonroutine nature of the strategic planning process means that the demands for this information will be infrequent.

The information needs for operational control are virtually opposite to those of strategic planning. Since this process deals with specific task accomplishment, it requires well defined and accurate information which is generated internally. This information must also be available on a frequent basis and in greater detail.

The management control process encompasses the totality of the organization and as such deals with some aspects of strategic planning and operational control. As a result, the information requirements of management control fall in between those of the other two processes. Anthony emphasizes that the information for the management control systems must be of an integrated nature, encompassing the varied and detailed requirements of the operational control system and the broad requirements of the strategic planning system. He suggests that the common denominator is money and, therefore, information in the management control system should be expressed in monetary terms.

These general information characteristics and their relationship to the framework are illustrated in Table II-A.

This summary is subject to the same limitations and uncertainties which are applicable to the concepts of management control, strategic planning and operational control. However, it does illustrate the contention that the inherent differences in the processes result in different information requirements.

| CHARACTERISTICS OF INFORMATION | OPERATIONAL CONTROL | MANAGEMENT CONTROL | STRATEGIC PLANNING |
|---|---|---|---|
| SOURCE | LARGELY INTERNAL | → | EXTERNAL |
| SCOPE | WELL DEFINED, NARROW | → | VERY WIDE |
| LEVEL OF AGGREGATION | DETAILED | → | AGGREGATE |
| TIME HORIZON | HISTORICAL | → | FUTURE |
| CURRENCY | HIGHLY CURRENT | → | QUITE OLD |
| REQUIRED ACCURACY | HIGH | → | LOW |
| FREQUENCY OF USE | VERY FREQUENT | → | INFREQUENT |

INFORMATION REQUIREMENTS BY MANAGEMENT FUNCTION (3)

TABLE II-A.

The degree to which the decision making process is structured or unstructured also has implications on the information required. If a decision process is structured to the extent that a model is in existence or can be constructed, the model will identify what information is required in very definite terms. If, however, the decision making process is unstructured, the information requirements will be ill-defined and the relevant information will require identification on a case by case basis.

2. System Characteristics

In general terms, an information system collects source data and transforms or converts it into meaningful and useful forms. It is somewhat analogous to the process of purchasing raw materials, producing finished goods, and distributing the finished products to customers. Drawing on this analogy, the system can be viewed as having three stages: inputs, processing and outputs. The manner in which these stages are accomplished is influenced by the needs of the user as characterized by his position in the framework. Therefore, the method of operation of the system and the system characteristics will in some respects be driven by these same considerations.

For example, the input or data collection techniques appropriate for operational control would be dictated by the need for current information and frequent updating. An on-line computer terminal would fulfill these requirements but would not be necessary for the input of data to a system designed for strategic planning. The basic differences in the characteristics of the information required by the various cells in the frameworks indicate that quite different data base or storage arrangements are required to support the decisions encountered in each area. Strategic planning decisions require a data base with less accurate information which may be subjected to complex simulation models while operational control decisions require larger

amounts and more detailed information processed through less complex models.

It can be seen that the frameworks provide a perspective from which to view information systems methods of operation and characteristics to determine the proper system to adequately fulfill the users' needs. A more detailed description of system characteristics which the user and system designer should consider in the design of a specific system will be presented in a subsequent section of this chapter.

3. System Design Process

The implications of the frameworks on the design process are in the areas of the organizational level to be served, the types of models to be employed and the goals of the system under design.

Individuals within an organization typically make different types of decisions depending upon their organizational level. It would be rare to find first line supervisors involved in strategic planning, and conversely, the president or head of an organization should make relatively few operational decisions. Thus, if the level of management for which the system is to be designed is well identified, the Anthony framework is useful in presenting considerations to be made with respect to information requirements and system characteristics. The real point here is that the design of an information system depends heavily on the individuals who will use it.

The sources of models for operational control are numerous. There is a history of applications, the problems are often similar across organizations and the systems are well documented. In strategic planning, and to a lesser extent management control, systems are still in the early stages of development. Models tend to be individual and are derived from the managers involved. It is a model creation process as opposed to a model application process. In general, it can be said that the information system's problem in the structured area is basically one of implementing a given general model in a particular organizational context; however, work in the unstructured areas is much more involved with model development and formalization.

Gorry and Scott-Morton state that to improve the quality of decisions a systems designer can seek to improve the quality of the information inputs or to change the decision process, or both.[3] If an appropriate model is in existence, it would follow that better information would provide better decisions or control. However, in the case of an unstructured process the improved information may not be as fruitful (see ACKOFF [4]). This contrast implies that different design goals are appropriate for different applications within the context of the framework.

The goal of an information system in a structured setting is usually to improve the processing and quality of information. In unstructured situations the goal of the

information system may be primarily to improve the presentation of information to the manager and to help in structuring the problem.

The system design process will be dealt with more extensively in a subsequent portion of this chapter. Again, the perspective gained by the adoption of the framework will be helpful in addressing specific areas of system design to fulfill the particular users' requirements.

## D. INFORMATION SYSTEM CHARACTERISTICS AND CONSIDERATIONS

The first section of this chapter dealt with the portion of the Webster definition of a system which included the "common purpose" for which an information system would be proposed and designed. The second section addressed some of the implications of the "common purpose" upon the system structure and characteristics. This section will expand upon those system physical characteristics which are included in the Webster definition as "a complex unit formed of many often diverse parts ..." and address the various considerations which must be undertaken in evaluating those physical characteristics with respect to a particular MICS design.

### 1. System Characteristics

An information system was previously defined as a means of transforming or converting source data into meaningful and useful information. This transformation can be viewed from an operational perspective, i.e., what functions

or operations must be performed, and from a technical perspective, i.e., through what methods these operations can be performed.

a. System Operations

While the exact sequence of operations required to convert particular items of data into information may vary to some extent, a general set of operations can be identified. Burch and Strater contend that these operations include capturing, verifying, classifying, arranging (sorting), summarizing, calculating, storing, retrieving, reproducing, and disseminating/communicating.[5] A description of these operations and a grouping in terms of input, output, and processing is presented in Table II-B.

| | | |
|---|---|---|
| INPUT | CAPTURING | RECORDING OF DATA FROM AN EVENT IN SOME FORM OF DOCUMENTATION |
| | VERIFYING | VALIDATING THAT DATA WAS CAPTURED CORRECTLY |
| PROCESSING | CLASSIFYING | PLACING DATA INTO SPECIFIC CATEGORIES WHICH PROVIDE MEANING TO THE USER |
| | ARRANGING (SORTING) | PLACING DATA ELEMENTS IN A SPECIFIED SEQUENCE |
| | SUMMARIZING | COMBINING OR AGGREGATING DATA ELEMENTS EITHER MATHEMATICALLY OR LOGICALLY |
| | CALCULATING | COMPUTING OR OTHER ARITHMETIC AND/OR LOGICAL MANIPULATING OF THE DATA |
| | STORING | PLACING DATA ONTO SOME STORAGE MEDIA FOR FUTURE RETRIEVAL |
| OUTPUT | RETRIEVING | SEARCHING OUT AND GAINING ACCESS TO SPECIFIC DATA ELEMENTS FROM STORAGE |
| | REPRODUCING | DUPLICATING DATA FROM ONE MEDIUM TO ANOTHER |
| | DISSEMINATING/ COMMUNICATING | TRANSFERING DATA FROM ONE PLACE TO ANOTHER |

INFORMATION SYSTEMS OPERATIONS AND DESCRIPTIONS

TABLE II-B

b. Systems Methods

Advances in technology have resulted in many devices that can be utilized to perform the ten basic data operations as outlined by Burch and Strater. The information system in most large organizations is generally composed of a variety of technological and manual methods. Based on the level of automation represented, Burch and Strater presented four broad categories of data processing methods which they defined as (1) manual, (2) electromechanical, (3) punched card equipment, and (4) electronic computer.

In the manual method all of the data operations are performed by hand with the aid of basic devices such as pencil, paper, vis-boards, etc. The electromechanical method is actually a combination of man and machine. Examples of this method would be an operator working at a tub file, calculator or duplicating machine. The punched card equipment method is sometimes referred to as the Electronic Accounting Machine (EAM) method. The principal recording medium is the punched card. A number of cards which contain data about a similar subject are grouped together in a tray of cards usually termed a file. A typical punched card system is comprised of any or all of the following devices: key punch, verifier, sorter, collator, reproducer, accounting machine, calculating punch, interpreter, and summary punch. It is worthy of note here that the recent advances in small computer technology are rapidly obsoleting punched

card equipment as a primary data processing method; however, many of these systems are still in existence.

In general, the preceding methods utilize an individual, or a particular machine to perform each data operation separately. The development of the electronic computer allowed one machine to perform most of the data operations without intermittent human intervention. The electronic computer, as the term will be used in this thesis, means a configuration of input devices, a central processing unit (CPU) and output devices. There is a large variety of hardware available in a myriad of electronic computer system configurations. It is not the authors' intention to explore or describe these devices in detail but rather to point out their capabilities which warrant consideration in the development of a management information and control system application.

The four methods of data processing which have been briefly described above are illustrated in Table II-C, along with their relationship to the data operations they perform.

2. Systems Considerations

The old adage of "to get the right answers, you must ask the right questions" is particularly germane to the design of a MICS. In order to obtain a system which will satisfy the users' requirements, the user and designer must be able to translate the users' requirements into system capabilities. As pointed out previously, no specific model

| Operations / Methods | Capturing and Initial Recording | Classifying | Arranging | Summarizing | Calculating | Storing | Retrieving | Reproducing | Disseminating and Communicating |
|---|---|---|---|---|---|---|---|---|---|
| Manual Method | Voice; observation; handwritten records; forms and checklists; writing boards; peg-boards | Hand-posting; coding; identifying peg-boards | Alphabetizing; indexing; filing; edge-notched cards | Hand calculators | Human calculation; pencil and paper; abacus; slide rule | Columnar journals; ledgers; index cards; paper files | File clerks; stock clerks; book-keepers | Hand-copying; carbon paper | Hand-written reports; hand-carried, or mailed |
| Electro-mechanical Method | Typewriter; cash register; autographic registers; time clocks | Posting machine; cash register; accounting machines | Semi-automatic (roto-matics; gather-matics) | Adding machines; calculators; cash registers; posting machines | Accounting machines; adding machines; calculators; cash registers; posting machines | Mechanical files (rotary or tub files); microfilm | | Duplicating equipment (carbonization, hectograph, stencil, offset, photocopying thermograph); addressing equipment | Telephone; teletype; machine prepared reports; message conveyors; hand-carried or mailed reports |
| Punched Card Equipment Method | Key punch; verifier; mark-sensed cards; prepunched cards; machine readable tags | Sorter; collator | | Accounting machine; calculator; summary punch | | Card trays | Sorter; collator; hand selection | Reproducers; interpreter | Same as above |
| Electronic Computer Method | Key punch; verifier; paper tape punch; magnetic encoder; OCR en-scriber; collection devices; conversion devices; terminals | By systems design | Card sorter; internal computer sorting | Central processing unit | | CPU, DASD; magnetic tape; paper tape; punched cards | Online inquiry into DASD; report generation | Same as above, plus on line copies from line printer; computer input/output; microfilm | Same as above, plus on line data transmission (tele-communication); visual display: voice output |

Operation and methods of data processing.[5]

TABLE II-C

for designing a MICS was discovered in the literature; however, a number of considerations in the accomplishment of an MICS design were presented by various authors. These considerations will be discussed from the viewpoint of the systems input, processing and output functions.

a. Input Considerations

The system input functions or operations are shown in Table II-B as capturing, initially recording and verifying the data to be entered into the system. An initial input consideration is the number and organizational level of the users of the system. How many people will actually require the ability to enter data? Who will actually enter the data? Will some data be sensitive and therefore require inputing from only designated people? What resources for data gathering and entering are currently in existence or are attainable? Does the user manager want to have the capability to enter data himself?

The verification function brings forth two opposing viewpoints. One viewpoint is that a system which segregates the data collecting, recording, and entry functions will provide more chance for the detection of errors. The opposite viewpoint is that the more people or iterations involved, the greater the likelihood errors will occur and remain undetected. Both these viewpoints have merit and require consideration.

The source of the input may have a significant impact on the requirement for verification. If an EAM or computer application is to be used, can the operator read

handwritten input data or must it be directly machinable? The application of this function to the system should be evaluated in light of the above as well as in the context of the conceptual framework previously discussed, i.e., the appropriate accuracy of the information required.

b. Processing Considerations

The processing functions as depicted in Tables II-B and II-C make up the majority of the system's operations. A primary consideration in the total system operation and in the processing functions in particular is time. The total system time and the processing time can be characterized in two ways: response time and frequency.

Response time or turnaround time can be described as the measure of total time required to complete a cycle of the system. In the case of the processing functions, this would be the amount of time required to accomplish the necessary processing operations appropriate for the data input and desired output. For the total system this would include the time required for the input functions and output functions as well as the time required by the processing functions.

Frequency is the measure of how often the system cycle is completed. The consideration here is both in terms of user requirements and system capabilities. How often does the manager require the processing functions

performed? This will depend upon his position as depicted in the conceptual framework and the framework implied information requirements. The system capability for frequency of operation will be tied to the response time and the resources available to iterate the process. In general, both the response time and frequency capabilities of a system are improved with higher applications of automation given a reasonable volume of data to be manipulated.

Another consideration relative to the processing functions is volume. The quantity of data which must undergo the various operations must be determined. The number of categories to be used for the classifying operation must be identified, and the amount and complexity of summarizing and calculating activity must be specified. The larger the volume of the processing operations the more resources, be it more people or more sophisticated equipment, which will be required to meet the users' demands.

Storage and retrieval requirements must also be considered. The volume and detail of the files to be maintained should be evaluated. If a computer based system is being considered, an estimate of how long the file data should be retained and the media for storage are important - file storage on computers is expensive. If the data can be printed and stored in file cabinets where only occasional access is necessary, it will cost far less than a computer direct access storage device (DASD) such as magnetic disc, drum, or data cell which would provide instantaneous access.

A trade-off must be made between hardware cost and slower access to data.

There are two different approaches to the accomplishment of the processing functions in an electronic computer based system: batch processing and on-line processing. Batch processing is characterized by a periodic (daily, weekly, monthly, or other convenient time frame) performance of the processing functions on the data accumulated over the prescribed interval. An on-line system processes each transaction as it occurs. Although these two approaches to the processing function tend to be mutually exclusive, there are examples of batched data transaction being input on on-line systems.

There are practical differences between batch and on-line systems in a number of areas. Batch systems usually have separate data collection and preparation activities such as keypunching source documents to punch cards, preparing magnetic tape from punch cards, record sorting, and so forth. On-line systems, on the other hand, usually collect data as transactions occur and transmit it directly to the computer without any intervening operations.

Batch processing often involves reading the appropriate program into core storage and performing certain housekeeping activities before the data can be processed. Processor set-up activities are minimized in an on-line system since the system is actually maintained in a state of constant readiness.

In batch processing every single master record must be read into fast memory (core storage) for record key comparison with the current transaction record. If the number of transaction records is small, relative to the total number of records in the master file, processor efficiency may be rather poor. Under the same circumstances, on-line processing is more efficient since only the active master records are actually accessed. An additional consideration, however, is the problem of idle computer time when no transactions are entering an on-line system. Overall, batch processing makes somewhat more efficient use of processor capacity than on-line processing.

Batch processing usually requires fewer types and smaller capacity equipment than on-line systems. Remote terminals and auxiliary storage capacity are not necessarily required with batch systems, but are normally needed for on-line systems. The processor capacity of on-line systems may need to be larger in order to handle peak transaction activity loads. Also, the computer operating control systems (software) for on-line systems tend to be more complex, expensive, and troublesome than that required for batch systems.

On-line inquiry combined with off-line (batched) updating represents an intermediate state of complexity that can prove adequate in many instances. Here the data base is updated by conventional off-line processing and made available for management inquiries during the working day with

the restriction that no updating occur during that time and with the day's transactions batched for entry in the evening.

c. Output Considerations

The considerations pertinent to the output functions of the system include a number of the same considerations set forth in terms of the other system functions. An acceptable timeframe in which to actually retrieve, reproduce and disseminate the required information must be defined by the user. The number and content of output reports must be addressed. Can the users' requirements be satisfied with a specific number of reports at prescribed intervals or is a free form interrogation of stored data required? These considerations will have a direct effect on the processing method of a computer system. The reports generated by a batch system are necessarily tied to the same cycle as that of the input and processing functions (e.g., daily, weekly, etc.). The manager is then tied to this schedule as well.

The format of output reports should be addressed. Must the reports be hand copy or can quick-look cathode ray tube (CRT) displays suffice? If hard copy reports are needed, what will the physical requirements be in terms of size and format? Will charts or graphs need to be plotted or will output be in straightforward text? The volume of output reports required and their dissemination should also be included in the evaluation.

The need for output security should be determined. Will some of the output information be considered sensitive and therefore require restricted access? The methods of insuring this security will vary depending upon the type and design of the information system selected. While restriction of output data may be more difficult in an automated system than in a manual one, provisions can be made to preclude free access to certain outputs.

## E. THE INFORMATION SYSTEM DESIGN PROCESS

Previously the authors indicated that the characteristics of the Anthony and the Gorry and Scott-Morton frameworks have explicit implications on the information system design in three general areas: information requirements, system characteristics and the system design process. To this point, the system information requirements and system characteristics/capabilities have been discussed. This section will pursue the system design process itself.

### 1. Definition of the Design Process

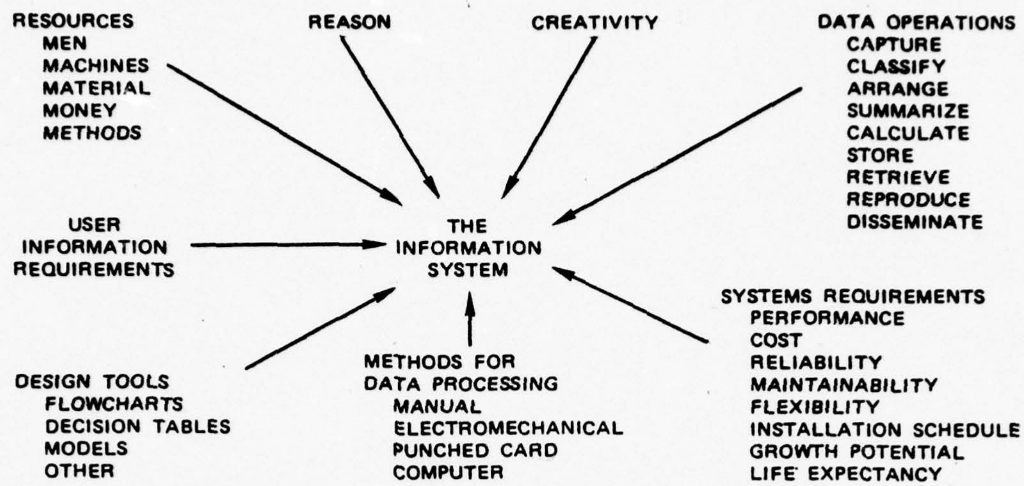
The design process is what ties the managerial function of planning and control, information characteristics and requirements, and information systems' characteristics and capabilities together to produce a desired MICS. "Systems design can be defined as the drawing, planning, sketching, or arranging of many separate elements into a viable, unified whole."[5] In a MICS this can be viewed as

the amalgamation of management functions and requirements with information systems capabilities.

The Survey and Requirements phases of the MIS development cycle as outlined in Chapter One consists of a systems analysis which addresses the questions of _what_ the system is doing and _what_ it should be doing to meet user requirements. The systems design process is concerned with _how_ the system is constructed to meet these requirements. The development cycle also shows that the design process is a long, sequential one which starts with a vary macro viewpoint in the requirements phase and gradually defines and refines the system requirements into a final form capable of implementation.

2. _Design Approaches_

As indicated at the outset of this chapter, no specific model for the design of a MICS was found in the literature. The admission of the lack of a singular model is perhaps best illustrated by the description of the design process presented by Burch and Strater. They state that "in order to design a system the analyst must possess knowledge related to the following subjects: 1) organizational resources, 2) user information requirements, 3) other systems requirements, 4) methods of data processing, 5) data operations, and 6) design tools. To produce a systems design, the analyst must apply reason and creativity to these elements of knowledge."[5] Figure II-2 provides a pictorial representation of this relationship.




AN ILLUSTRATION OF THE ELEMENTS COMPRISING THE DESIGN PROCESS FOR AN INFORMATION SYSTEM (5)

FIGURE II-2.

a. Burch and Strater Approach

Burch and Strater do, however, outline some basic steps in their own approach to a design process. These steps include: 1) defining the system goal, 2) developing a conceptual model, 3) applying organizational constraints, 4) defining data processing activities, and 5) preparing the System Design Proposal.

Defining the system goal is a result of the findings in the Survey and Requirements phases of systems analysis. The goal or goals need not be stated in specific informational requirements but rather in the purpose or desired result of the implementation of the system.

Developing a conceptual model of the system is nothing more than a gross depiction of the inputs and de-

sired outputs of the system and the indication that some processing is required to effect this conversion.

Organizational constraints are defined in terms of resources available. These resources can take the form of manpower, machines, money, material or methods. Normally the information system must vie with other activities to obtain the necessary resources. This fact leads the manager and systems analyst to consider cost/effectiveness to the organization in the design and development of the system.

In defining the data processing activities which the system requires Burch and Strater contend that you must begin with the identification of the desired outputs of the system. The next step is to list the specific information fields required to prepare that output and identify the specific input data required to develop those fields. Then the processing operations which will convert the inputs to the desired outputs must be addressed and defined. Having completed these steps for all desired outputs, the analyst should then consider the data base (file system and structure) and control points necessary to support the outlined system design.

Earlier, the point was made that the information needs of managers at different levels of the Anthony framework were very different from one another and that this difference was one of fundamental difference of characteristics, not just a matter of aggregation. This difference is reflected in the Burch and Strater design process of the

system through the "tailoring" of the information system to the users' requirements. Burch and Strater present several specific methods for tailoring the information system to the requirements of an organization. These methods are useful regardless of the overall structure of the information system, and though presented individually, are also applicable in varying degrees of combinations to meet specific user requirements.

Burch and Strater contend that the effectiveness of an information system can be improved by the following five basic methods: 1) filtering method, 2) monitoring method, 3) modeling method, 4) interrogative method, and 5) external method. The purpose of each of these methods is to provide the user the information required in the most efficient and effective way possible.

The filtering method is based on the premise that various levels of decision makers require various levels of detail information as outlined in both the Anthony and Gorry and Scott-Morton frameworks. Ideally, the information system should be designed to permit the filtering of selected data elements from the data base so that each decision maker can obtain the level of detail appropriate to his or her individual needs.

The monitoring method is another alternative for reducing the amount of data managers receive while still increasing the amount of relevant information at their

disposal. Instead of producing streams of data to be handled by the manager, the information system monitors the data and provides informational outputs to the user on a predetermined basis. The three basic ways to implement the monitoring method are: 1) variance reporting, 2) programmed decision making, and 3) automatic notification.

Variance reporting requires the establishment of normative values of performance and an acceptable amount of deviation (variance) from that norm. When the acceptable variance is exceeded the system automatically prepares a report to the responsible manager.

Programmed decision making involves the use of the system to execute routing decisions based on predetermined check points or values. Only those items which exceed the parameters of the decision model would be referred to the manager for resolution. This method is most applicable to the structural, operational level of decisions as depicted in the Gorry and Scott-Morton framework.

The automatic notification method is used to take advantage of the vast memory capabilities of computors. The system merely monitors a large file of data and presents information on a predetermined basis. For example, a prioritized list of tasks to be accomplished can be input in the system, and as each task is completed the system will direct the user as to which task must be undertaken next.

The modeling method utilizes various logico-mathematical models to transform data elements into desired

information. They are used primarily to provide information of a predictive nature based upon the model parameters and the historical information furnished by the user. This method would normally be used by strategic planners and is constrained by the accuracy and capabilities of the model employed.

The interrogative method relies on the user to format a specific inquiry to the system to meet a specific but previously unanticipated requirement. The system does not disseminate information until a specific request is received. While the concept here would allow for the ultimate in providing relevant data to the manager, the system requires an expensive investment in data processing resources and an extraordinarily large data base in order to respond to the unlimited or unstructured requests of the user.

The external method refers to gathering information which is generated outside of the organization. As organizations become larger and more complex, the outside environment will become of greater importance and external information has to be communicated in a formal manner rather than on occasional collections and observations of the managers themselves. This method is obviously directed toward the strategic decision maker.

b. Wilkinson Approach

Dr. Joseph W. Wilkinson outlines three different design approaches in his article "Classifying Information

Systems" which was published in the Journal of Systems Management, April, 1973.[6] Dr. Wilkinson contends that an information system may be simultaneously viewed as a data converter, a decision-oriented network, and a data base. These three views correspond respectively to what he terms "the three phases in the evolution of information system design" which has occurred over the past twenty years. These three phases are: 1) designing efficient operating systems, 2) designing output-oriented scheduled reporting systems, and 3) designing input-oriented demand reporting systems.

These three perspectives and corresponding design approaches appear to fit well within the Anthony and the Gorry and Scott-Morton frameworks. The perspective of the system as a data converter corresponds to the focus upon designing information systems in support of the operational level where the objective is to provide efficient data conversion operations within well-defined bounds. The particular activity which this type of MIS is to serve is normally a structured one and therefore the design process becomes one of merely specifying the data collection, data processing and output data communication operations as dictated by the structure.

The perspective of the decision-oriented network appears to correspond with Gorry and Scott-Morton's categories of structured or semi-structured management control. This decision-oriented network viewpoint emphasizes

the regularly recurring flows of data and information between the operational level and the decision-making level which enable the managers to make planning and control decisions. The design process as described by Wilkinson in this decision-oriented network perspective is an output-oriented approach in which the initial effort is devoted to determining what information is needed by whom, how often it is needed, etc. When the characteristics of the needed information are fully specified the system designers work backwards to specify the input data and conversion processes necessary to provide that information. A basic assumption underlying this approach is that regularly scheduled reports can provide managers with the information they need for successful completion of most of their responsibilities.

The data base perspective emphasizes the collecting and organizing of data for use by managers in decision making in an unpredictable environment. This outlook can be interpreted as the unstructured managerial control level or the strategic planning level. The input-oriented design approach which Wilkinson contends is necessary to support this perspective concentrates on data collection and storage for random retrieval. The assumption underlying this approach is that the environment of the manager is so dynamic that he cannot know in advance what decisions must be made and therefore he cannot determine and specify much of the information he needs. Consequently, the design approach is to select and organize for easy retrieval a

massive variety of data that has some probability of being needed. As the manager encounters an unexpected decision, the system provides the requested information promptly in a flexible reporting format.

3. Summary

The use of the above design approaches will aid the information system designer in bridging the gap between user requirements and system definition. By highlighting the users' perspective and relevant information needs and relating them to a method or combination of methods for providing that information the designer will begin to define the system capability requirements in terms of system considerations and system characteristics.

## F. CRITERIA FOR SELECTION OF SYSTEM TYPE

A MICS can be designed which will meet the users' requirements in a variety of ways as shown in the previous section. Furthermore, the system design can be specified without stipulation of the data processing method in most cases. How then do the user and system designer decide upon the proper method for a particular application?

Burch and Strater contend that this selection requires consideration of both processing requirements of the system and performance capabilities of each processing method. The processing requirements can be viewed as being determined by: 1) the volume of data elements involved, 2) the complexity of the required data processing operations,

3) processing time constraints, and 4) computational demands. As in other aspects of the MICS design and development, no specific model exists to determine the exact degree or level of these requirements which corresponds to a given processing method. However, it can be stated in general that as the volume of data increases, as complexity increases, as time constraints become more severe, and as computational demands become more sophisticated, an increased level of automation is warranted. Not all these conditions need be present. It may be that a single processing requirement is so dominant that an advanced level of automation is warranted on that parameter alone.

| Factors \ Data Processing Method | Manual | Electromechanical | Punched Card | Computer |
|---|---|---|---|---|
| Initial Investment | Low | Moderately low | Medium | High |
| Set Up | Low | Moderately low | Moderately high | High |
| Conversion | Low | Medium | Medium | High |
| Skilled Personnel | Low | Moderately low | Medium | High |
| Variable Cost | High | Medium | Moderately low | Low |
| Modularity | High | Low | Moderately low | Medium |
| Flexibility | High | Low | Medium | Low |
| Versatility | Low | Low | Medium | High |
| Processing Speed | Low | Moderately low | Medium | High |
| Computational Power | Low | Low | Medium | High |
| Processing Control | Low | Moderately low | Medium | High |
| Automatic Error Detection | Low | Medium | Medium | High |
| Decision Making | Moderately low | Low | Medium | High |
| Level of Degradation | Low | Moderately low | Medium | High |
| *Level of Automation* | *Low* | *Moderately low* | *Medium* | *High* |

Comparison of the four data processing methods [5] against fifteen basic performance factors.

TABLE II-D.

Performance capabilities are equally important in the consideration of a specific selection. While there are many dimensions of data processing to consider, Burch and Strater

outline fifteen basic factors. These factors are compared for each of the previously identified methods of data processing in Table II-D.

The real deciding factor in the selection process, however, may be economic. The user could choose the most sophisticated electronic computer system available to accomplish the simplest processing requirement if he wanted to pay for it. On the other hand, the user might have a legitimate requirement for that same system based upon the preceding criteria but be forced to tradeoff some of the system's capabilities in light of available resources.

If an electronic computer system is deemed appropriate for the users' requirements a further selection must be made among on-line processing, batch processing, or some combination of the two. In Information System Analysis: Theory and Applications, M. J. Alexander presents three factors pertinent to that decision: 1) cost, 2) quality, and 3) timeliness. Batch systems tend to be less costly per transaction because of more continuous use of the computer and reduced hardware/software requirements as discussed in a previous section. Alexander contends that batch systems have fewer errors since it is difficult to check on-line systems for accuracy. This evaluation is the basis for some debate, as stated previously. On-line systems can provide more current information than batch systems due to the basic nature of the operation. If timeliness is crucial to the operation, an on-line system is dictated. However, if

timeliness is not that crucial a batch system or combination of batch and on-line inquiry as previously discussed are viable options.

## G. SUMMARY

This chapter has discussed current literature viewpoints in the areas of planning, control, and MICS. Concepts in the general areas of system information requirements, characteristics, design processes, and selection criteria were presented in order to give the reader a perspective from which to examine and evaluate the MICS situation and requirements of the SPO/NWC. The subsequent chapters of the thesis will deal with application of the Survey, Requirements, and Preliminary Design Phases of the Rigo MIS development model to the SPO/NWC.

## III. CURRENT SPO/NWC OPERATION SURVEY

### A. BACKGROUND

The methodology adopted for this thesis research calls for a survey phase to investigate the current situation thoroughly and systematically in order to answer the key questions "what are the facts" and "what is the real problem?". The literature points out that there are both advantages and disadvantages to studying the existing systems. The primary disadvantages of analyzing the existing system are that it is expensive in terms of time and resources, and that it may introduce unnecessary barriers or biases in the development of subsequent systems.

There are four advantages in analyzing the present system. First, the current system may not require replacement in total. Minor modification may result in satisfying the information and control needs of the user. Secondly, investigation of the current system will reveal specific areas which need improvement and point out problem areas which must be dealt with if the development of a new system is necessary. Thirdly, analysis of the current situation will provide data on the volume, sources, and characteristics of information required. Finally, analyzing the existing system can provide an immediate source of design ideas for the new system. Dr. Donald F. Heany, the author of Development of Information Systems, states that "designers say they discover the clues they need to satisfy the

proposed information requirement (during the course of analyzing the existing system). They do not know how this happens, merely that it does happen."[7]

For the above reasons, the authors have chosen to study the existing SPO/NWC organization and the information systems utilized. The investigation of the current situation at SPO/NWC is presented in this chapter and entails discussion in the areas of (1) organizational relationships, (2) roles and responsibilities, and (3) current management information and control systems.

## B. ORGANIZATIONAL RELATIONSHIPS

### 1. Naval Air Systems Command

NAVAIR is one of six subordinate commands of the Navy Material Command. The NAVAIR organization follows a concept employing functional and product organizations with line and staff organizational structures. Appendix A depicts the NAVAIR organizational structure. In addition, program management organizations are superimposed on the basic functional organization for prosecution of selected priority projects. PMA-259 is one of the NAVAIR selected priority projects.

The NAVAIR functional organization personnel are used to accomplish the program objectives established by PMA-259. These functional organizations provide the fundamental skills and disciplines required to support the NAVAIR

mission. These organizations are utilized by each NAVAIR program for basic technical and administrative support.

The interface on the Sidewinder Program between NAVAIR and NWC is PMA-259 and the SPO/NWC, as these two organizations have been delegated Sidewinder Program responsibility by their respective commands. Appendix B shows the NAVAIR functional organizations which support the Infrared Missile Program Office and their program relationship to PMA-259 and SPO/NWC. Of note is the number and diversity of functional disciplines/codes which furnish support to PMA-259 and the fact that these codes do not have line responsibility to PMA-259.

2. Naval Weapons Center

NWC is a major Naval Laboratory under the direction of the CNM. NWC is organized along functional lines and the SPO/NWC is located in the Engineering Design Division of the Engineering Department, as illustrated in Appendix C. It is of interest to note that the relationship of the SPO/NWC to NWC and the Engineering Department places the SPO/NWC within the functional line organization. This type of organization differs from the classic matrix organizational structure in which the SPO/NWC Manager would be external to the line functions and would occupy a position within the organization at the department or equivalent level. This more conventional matrix organizational relationship is illustrated by the PMA-259/NAVAIR organizational relationship.

The Engineering Department at NWC, as depicted in Appendix D, is staffed and organized to provide the technical disciplines required in the acquisition of a major weapons system. The technical functions of each division are shown in Table III-A.

Each of the technical divisions, and particularly the branches within each division, has a program interface with the SPO/NWC as depicted in Appendix E.

Appendix E details the functional and Sidewinder program lines of responsibility and authority within the NWC organization. As shown, the SPO/NWC has program management interface not only with branches within the Engineering Department but with functional branches in other departments. Examination of Appendix E indicates the magnitude, complexity, and diversity of the organizational relationships that exist between the SPO/NWC and the functional divisions/branches which result from the application of the program manager concept. As previously noted, the SPO/NWC is organizationally located at the branch level, and this fact increases the management planning and control function difficulties inherent within a program manager/functional organization relationship.

3. SPO/NWC Organization

The SPO/NWC is organized to support the production, development, test, and integrated logistic support (ILS) functions of the program. The fiscal, clerical, business, and data functions are performed by a staff organization in

| | | |
|---|---|---|
| Engineering Services Division | o | Materials engineering research, development, and testing |
| | | Microelectronics component technology capability, environmental testing facilities |
| Engineering Design Division | o | Technical design, analysis, and testing on infrared missiles and components |
| Product Design Division | o | Technical design, analysis and testing of radar missiles and components |
| Engineering Prototype Division | o | Establish and maintain mechanical and electrical fabrication facilities |
| Technical Data Division | o | Configuration and Data Management capabilities |
| Fleet Engineering Division | o | Provide Integrated Logistics Support from basic analysis and planning through implementation Fleet support engineering to Fleet personnel |
| Product Assurance Division | o | Provide Product Assurance support to Center programs in planning, coordination, and implementation of Systems Safety, Quality Assurance, Reliability/Maintainability, Failure Analysis Systems Effectiveness, Soldering Technology, and Manufacturing Technology |

NAVAL WEAPONS CENTER DIVISIONS TECHNICAL FUNCTIONS

Table III-A

support of the major program functions. These relationships are shown in the organizational chart of the SPO/NWC as presented in Appendix F.

There are sixteen employees in the SPO/NWC organization. The fiscal and data functions are performed by personnel who are assigned to the office from other functional codes on a full time basis. The four functional managers are supported by project engineers who have responsibility for various components of the missile system; i.e., Guidance and Control Section (GCS), Active Optical Target Detector (AOTD), etc.

4. Participating Field Activities (PFAs)

The SPO/NWC has program interfaces with other Navy and Air Force activities. Appendix G lists the primary support activities with which the SPO/NWC maintains an interface and indicates the principal area of support provided by these activities. The coordination and liaison with these activities is required to fulfill the SPO/NWC management responsibilities for which technical expertise is not available within NWC itself.

5. Sidewinder Missile Component Contractors

One of the SPO/NWC responsibilities is to assist NAVAIR in the resolution of production problems. This role requires interface with companies who have hardware contracts for Sidewinder components. Appendix H lists the major component contractors and the components manufactured, with whom SPO/NWC maintains an interface.

## C. RESPONSIBILITIES/TASKS AND INFORMATION FLOW

### 1. Description of Responsibilities and Tasks

The SPO/NWC responsibility is delegated to the SPO/NWC via the Commander, NWC, through the line organizations (see Appendix C). These responsibilities flow from two distinct sources, i.e., the program responsibilities as defined in AIRTASKS and Work Unit Assignments and the NWC organization responsibilities as defined in NWC and Engineering Department instructions and policies.[8&9]

The SPO/NWC Manager, as head of the SPO/NWC, operates under the Sidewinder (AIM-9) Program Management Plan. The responsibilities as defined in the plan are: a) The overall missile system coordination function between NAVAIR sponsoring activities/co-sponsoring USAF activities/foreign country users and NWC, b) the overall missile system coordination function (as delegated by NAVAIR between the supporting field activities and NWC, c) the overall missile system coordination function (as delegated by NAVAIR between the primary and/or secondary source contractors for missile system hardware and NWC, d) the overall missile system coordination function between NWC supporting contractors or field activities and NWC, and e) the overall missile system coordination function between the SPO/NWC and the NWC supporting/participating codes.

To carry out his assigned responsibilities, the SPO/NWC Manager performs or directs the performance of the following: a) establishment, structuring, and supervision

of the SPO/NWC to carry out its assigned/delegated functions, b) acquisition and/or assignment of SPO/NWC staff members to perform assigned tasks in accordance with the established organizational and functional charts, c) establishment of policy and procedure guidelines for carrying out these assigned/delegated functions, d) preparation and/or implementation of task assignments to be performed together with the responsibility and authority assigned (including the determination of the in-house/off-Center structure), e) establishment and/or implementation of planning and control procedures for monitoring the progress of accomplishments, f) establishment and/or implementation of reporting procedures as required for off-Center sponsoring activities and NWC, g) preparation and presentation of program material/ briefings for off-Center sponsors and other Department of Defense official visitors, and h) establishment and maintenance of a permanent file for all program related information.

In summary, the basic responsibility of the SPO/NWC Manager is one of managing an organization with policies, planning and control techniques to perform the tasks/functions required to support the Sidewinder Program.

As shown in Appendix F, the SPO/NWC is organized to support the functional requirements of the AIM-9 series missile, i.e., development, test, ILS, and production. Using the SPO/NWC organization as the basis, Figure III-1

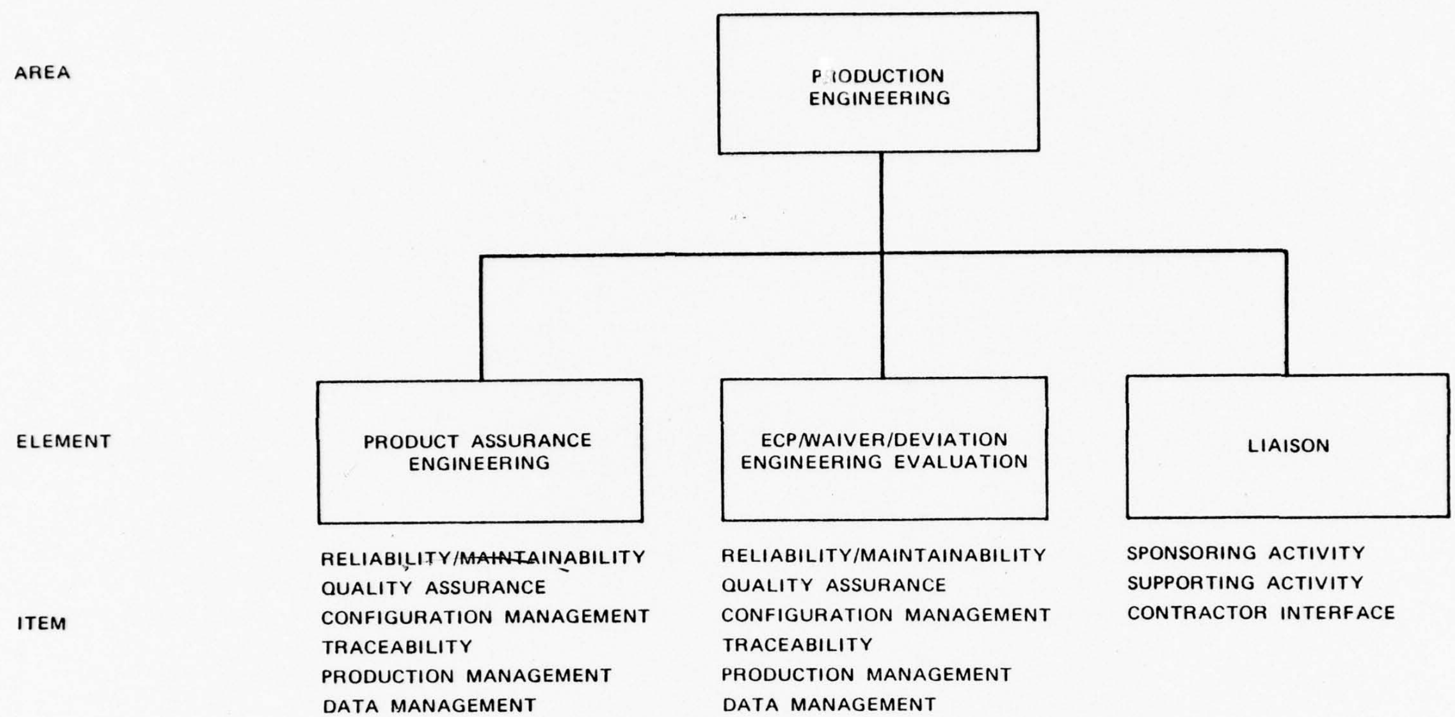
depicts the decision levels used by the SPO/NWC Manager to fulfill the assigned responsibilities.

| ORGANIZATION | RESPONSIBILITY |
|---|---|
| PROGRAM MANAGER | POLICY AND PROCEDURE GUIDELINES |
| PRODUCTION MANAGER | POLICY AND PROCEDURE IMPLEMENTATION |
| PROJECT ENGINEERS:<br>o GCS<br>o AOTD<br>o AFT COMPONENTS<br>o EXPLOSIVE COMPONENTS | OPERATIONAL |

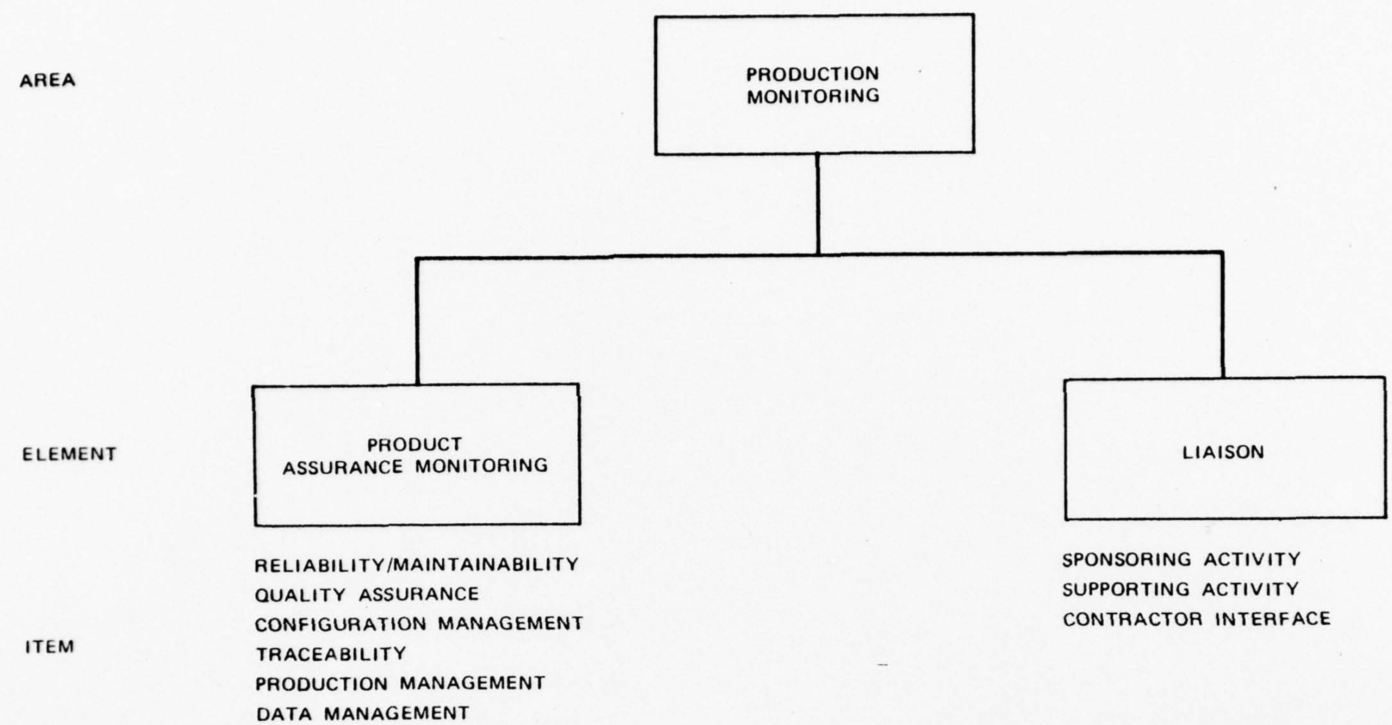
DECISION LEVEL DIAGRAM—SPO/NWC

FIGURE III-1

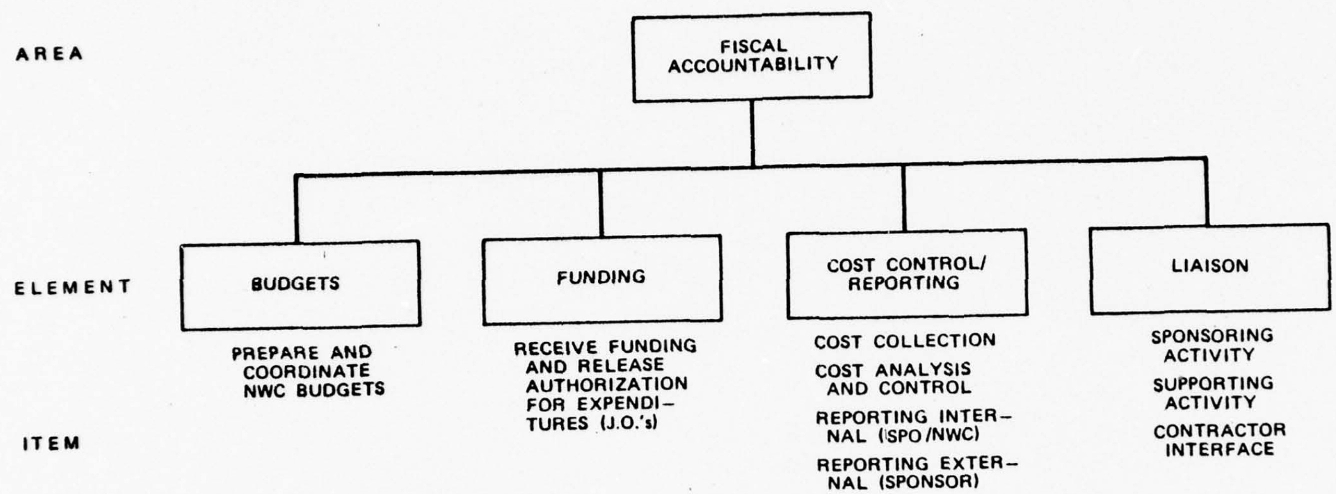
Figures III-2, III-3, and III-4 are functional charts which depict the functional areas, elements, and items for which the Production Manager has been delegated responsibility. The Production Manager has the responsibility to coordinate with each Project Engineer to ensure that the production engineering, production monitoring, and fiscal accountability areas are addressed within the Project Engineer's areas of responsibility. The Project Engineers have the responsibility for one or a series of missile components as illustrated in Figure III-1. Each Project Engineer is responsible for accomplishment of all tasks




**PRODUCTION MANAGER RESPONSIBILITIES – FUNCTIONAL CHART NO. 1**
**FIGURE III–2**




**PRODUCTION MANAGER RESPONSIBILITIES – FUNCTIONAL CHART NO. 2**
**FIGURE III–3**




**PRODUCTION MANAGER RESPONSIBILITIES – FUNCTIONAL CHART NO. 3**
**FIGURE III–4**



against budgeted amounts. The monthly summary is also sent

relating to his missile components in each of the functional areas of production monitoring and production engineering.

The budget, funding, and cost control/reporting elements, as shown on Figure III-4, are accomplished through a series of procedures performed by SPO/NWC staff personnel. However, the Project Engineers have the responsibility of monitoring actual costs versus planned expenditures. The primary responsibility of the production manager in the area of fiscal accountability is the establishment of job orders (JOs) under NWC fiscal guidelines.

The SPO/NWC AIM-9L production support responsibilities are defined through the AIRTASKS and Work Unit Assignments presented in Appendix I. These responsibilities are outlined in very general terms. Specific tasks are identified on an "as required" basis to support a specific contract. A similar situation exists with the SPO/NWC personnel's responsibilities, i.e., responsibilities are defined in general terms in personnel descriptions and through organization charts. Detailed tasks are assigned on an "as required" basis.

2. Assignment of Tasks and Information Flow

To this point, the discussion of the SPO/NWC operation has highlighted the organizational relationship, functions, and responsibilities of the organization and personnel in the AIM-9L production support effort. This section will identify how the previously mentioned detail tasks are received and assigned, the nature of these detail tasks, and

what kind of information requirements, characteristics, and interfaces are associated with these tasks.

The detailed tasks received by the SPO/NWC are as numerous and diverse as the previous discussions would indicate. They are received from any and all organizations discussed previously and take the form of phone calls, messages, letters, etc. In order to quantify the volume and form of these requests for task accomplishments, the authors collected data from correspondence files. In addition, the SPO/NWC Manager, the Production Manager and the GCS Project Engineer maintained logs of incoming requests for a period of twenty working days. The raw data and assumptions used to arrive at the volume and type data shown in Table III-B are contained in Appendix J. The data presented in Table III-B illustrates the volume, data form and organizational level of the information flow. This data will be used to assess the needed MICS characteristics and capabilities in the next chapter.

The characteristics of information received by each member of the office to fulfill his responsibilities is different. The difference is primarily in the level of detail and scope of information required for the decision making process, i.e., the Project Engineer is involved with many detail facts on one component of the Sidewinder missile, the Production Manager is involved with production problems encompassing all the components of the Sidewinder

| | TELEPHONE | MEETING OR DISCUSSION WITH ONE OR MORE PEOPLE | LETTER | MESSAGE | MEMORANDUM |
|---|---|---|---|---|---|
| B | 34 | 12 | * | * | * |
| C | 48 | 72 | * | * | * |
| D | 51 | 20 | * | * | * |
| OFFICE 9L PROD. SUPPORT | | | 78 | 26 | 53 |

B – SPO/NWC MANAGER
C – PRODUCTION MANAGER
D – PROJECT ENGINEER (GCS)

* CORRESPONDENCE IS ADDRESSED ONLY TO SPO/NWC

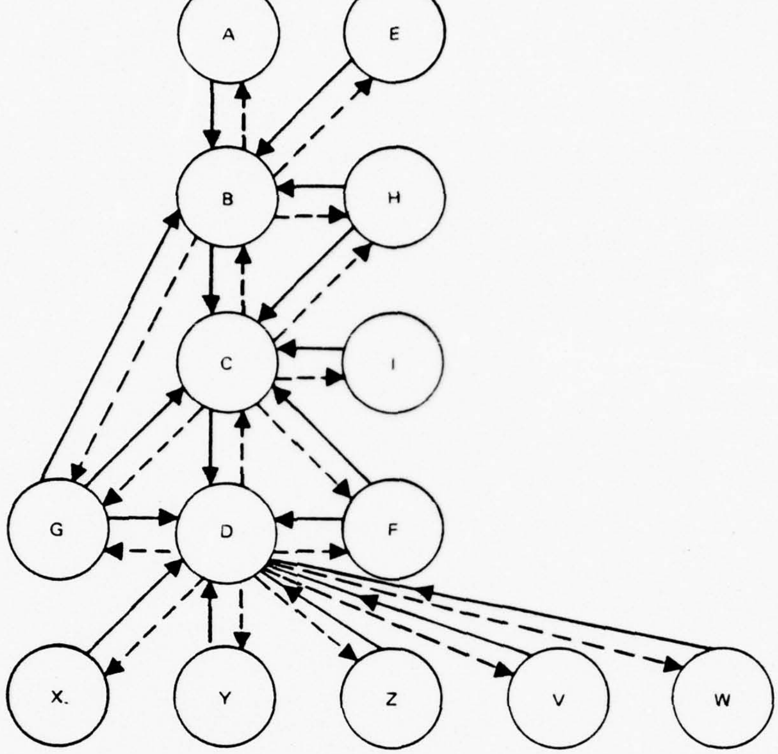
SPO/NWC INCOMING INFORMATION – TYPE/VOLUME
TABLE III–B

missile, the SPO/NWC Manager is involved with summarized facts for all functions of the program.

The flow of information (who receives/who requests) is also different. The Project Engineers' primary contacts are with the NAVAIR technical codes, contractor technical engineers, and NWC technical personnel and production managers. The Production Manager's primary contacts are with the NAVAIR Assistant Project Manager, NWC branch heads, and contractor program personnel. The SPO/NWC Manager's primary contacts are the NAVAIR Project Manager, other DoD Program personnel, NWC division and department heads.

Figure III-5 represents an information flow analysis from and to the SPO/NWC. For purposes of this study, only one Project Engineer is addressed. The other Project Engineers would have similar interfaces with applicable NAVAIR and NWC technical codes. The type and content of tasks and information flow for other Project Engineers would be similar. The different individuals and organizations that interface with the SPO/NWC personnel are noted. The solid and dash lines represent information flow into and out of the SPO/NWC, respectively. This analysis is helpful in showing the multiple informational interfaces at each level and the multidimensional aspects of the information flow.

The assignment of tasks within the SPO/NWC organization can be described as a structured or programmed decision-making process. The requests for task accomplishment are directed to the cognizant functional area and/or




INFORMATION FLOW INTO SPO/NWC
INFORMATION FLOW OUT OF SPO/NWC

A. ENGR DESIGN DIVISION HEAD
B. SPO/NWC MANAGER
C. PRODUCTION MANAGER
D. PROJECT ENGINEER (GCS)
E. INFRARED MISSILE PROGRAM MANAGER
F. GCS TECHNICAL ENGINEER (NAVAIR)
G. RAYTHEON COMPANY

H. ASST PROGRAM MANAGER (AIR-5105B)
I. NWC SUPPORT CONTRACTOR
X. RELIABILITY (NWC)
Y. QUALITY ASSURANCE (NWC)
Z. MATERIALS (NWC)
V. MECH AND SPECIAL EQUIP (NWC)
W. SYSTEMS ELEC (NWC)

INFORMATION FLOW DIAGRAM
FIGURE III-5

Project Engineer by the application of a predetermined area of responsibility guide. Distribution of incoming correspondence is made from a standard distribution list which relates subject to cognizant personnel, i.e., the Project Engineer (GCG) receives a copy of all correspondence relating to the GCG, the Production Manager receives a copy of all production related items, and the SPO/NWC Manager receives a copy of all correspondence. The Data/Configuration Manager (D/CM) receives all correspondence related to data (ECPs, contract data items, etc.) It is then the responsibility of each individual to take action on items (tasks) relating to their area of responsibility.

Examples of the process would be: 1) the D/CM receives all ECPs and starts them into the configuration control process, and 2) the Project Engineer receives a request for a specific task accomplishment and then processes action items by a formal task agreement or verbal arrangement with the functional codes, depending on funding requirements and scheduled time span. It is significant to note that the programmed method of task assignment within the SPO/NWC does not record these specific arrangements in any formal system. Sometimes a "tickler" copy of an action document which has been assigned to a particular Project Engineer is retained, or a note is made in the SPO/NWC Manager's notebook, but no formal record is kept on all assignments. Formal systems do exist to control and track certain items, such as ECPs and contract data items. These

systems will be discussed in the following section of the thesis.

The assignment of tasks by the SPO/NWC personnel to the NWC functional organization is accomplished through a task agreement system as indicated above. Each functional code which supports the SPO/NWC is issued a task agreement which defines the scope of work, funding required, and schedule anticipated for a given fiscal year. The Production Manager, Project Engineer, and SPO/NWC Manager as a team write these task agreements as a part of the yearly budget process. Task assignments are made within these task agreements in response to specific requests for work or information received by the SPO/NWC. The major tasks of the Project Engineer are to determine the progress of specific detail tasks against a general task agreement and meet program commitments. The Project Engineer has the responsibility to monitor the task progress on a continuing basis through personal contact and weekly fiscal reports. Additional task agreements are written for special efforts not anticipated at the start of the fiscal year, and where the funding requirement is greater than twenty-five thousand dollars. All these task agreements are in essence a formal contract between the SPO/NWC and each of the functional codes. Information flow among all the participants, as shown in Figure III-5, takes many forms. In addition to the "as required" communication flows previously discussed, there exists a requirement for formal periodic reports to

NAVAIR and NWC management from the SPO/NWC. These reports are to provide the overall program progress in terms of cost, schedule, and performance which is required for management decision making. A detailed discussion of these reports and the system for their generation will be undertaken in the next section.

## D. CURRENT CONTROL AND INFORMATION SYSTEMS

A single integrated MICS does not currently exist within the SPO/NWC. Rather, the existing system is made up of a number of disjointed systems designed to perform information and control functions in specific areas. These systems include the Correspondence Filing and Distribution System, Funding Control System, Task Agreement System, Mark III Management System, Data/Configuration Management System, Periodic Reports System, and Program Review Action Item system. This section will discuss each of these systems individually to gain an appreciation for their purpose, functions and effectiveness.

### 1. Correspondence, Filing and Distribution

The correspondence and filing system in the SPO/NWC is designed to log, distribute and file each item of correspondence which is transmitted from or received by the office. Correspondence as used herein is either a letter, message, transmittal receipt, speedletter or memorandum. The system functions are performed by a civilian contractor

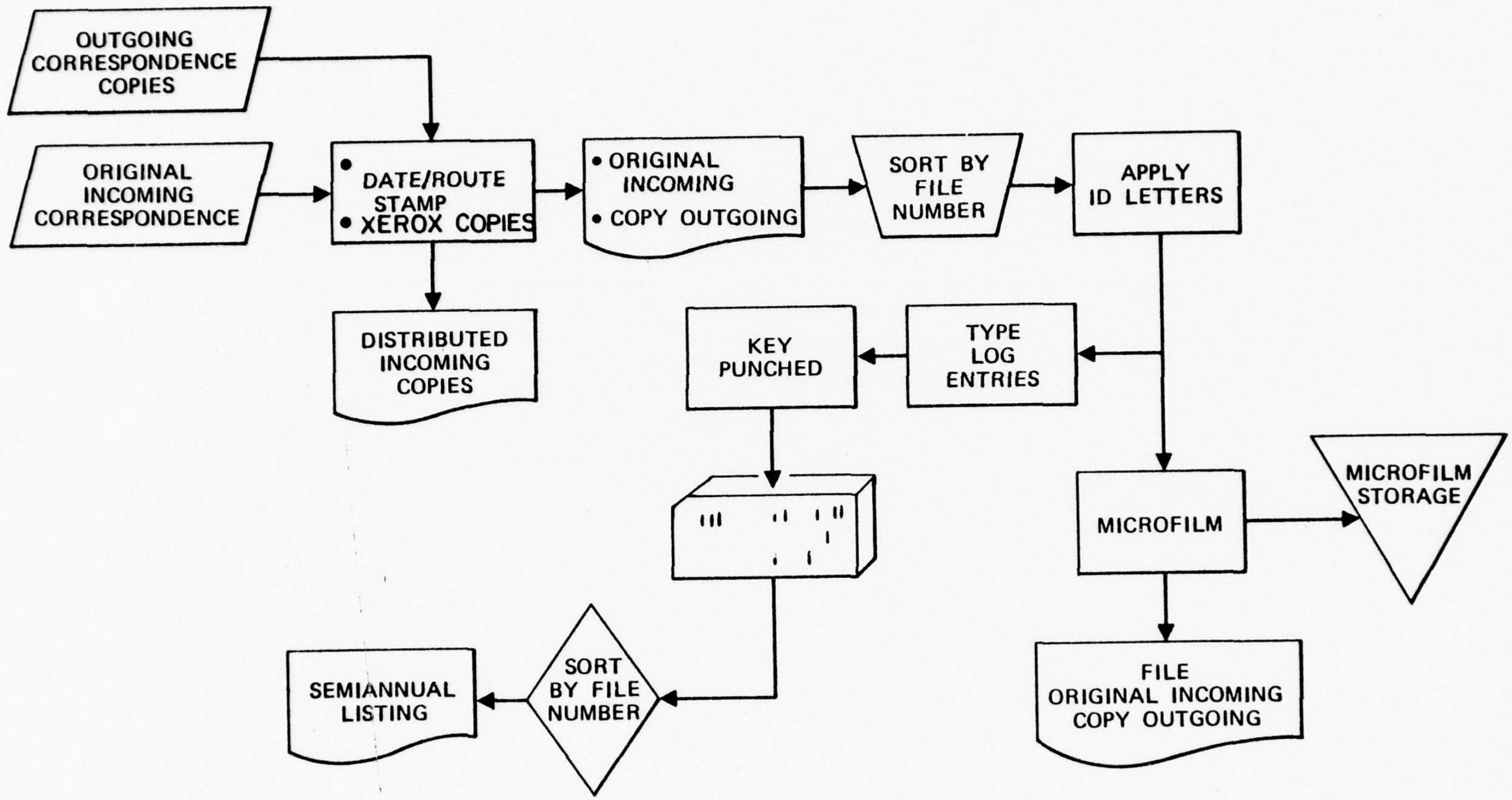
and utilizes the contractor person fulltime. The annual cost to the SPO/NWC is $24,000.

Figure III-6 depicts the steps which each item of correspondence follows through the system. The log entries and semi-annual listing contain the microfilm ID number, the date of the document, the type of correspondence, the originator file number, the originator's code or organization, the correspondence serial or registration number, the addressee name or code, the subject of the correspondence, and the title of any enclosures. Approximately a one day turn-around time is involved in the distribution, microfilm and file processes. The keypunching is not done on a regular basis. The sorting of the card deck file and production of the file number sequence listing is done semi-annually. The file copy is maintained in the SPO/NWC files for two years; after this time it is packaged, transferred to a federal storage facility, and stored indefinitely. The developing of the microfilm is done monthly and the microfilm cartridges are retained in the SPO/NWC.

The system is basically designed to provide a permanent record of all SPO/NWC correspondence. With the date and originator, any item of correspondence can be retrieved from the file system.

2. Funding Control Process

The description of the funding control process is limited to the interaction of the SPO/NWC and the NWC



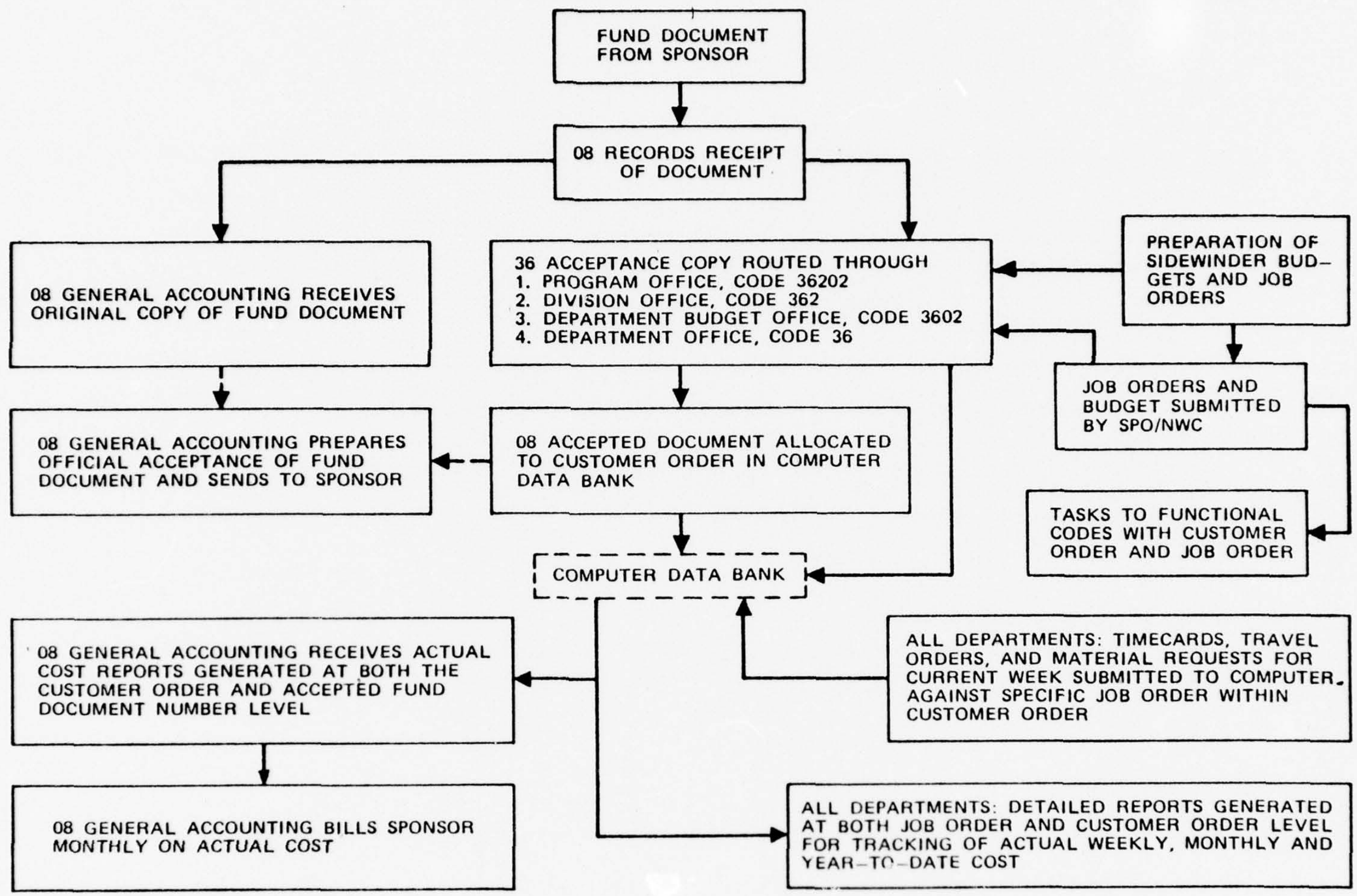

CORRESPONDENCE FILING AND DISTRIBUTION SYSTEM FLOW DIAGRAM
FIGURE III–6

Comptroller (Code 08) financial system and therefore does not include the Code 08 processing procedures. The SPO/NWC budget as submitted to PMA-259 (sponsor) is the basis for the funding received by NWC for the Sidewinder production support effort.

The funding system, as depicted in Figure III-7, is used to report, bill, and track the funding from sponsors for all NWC projects and programs. The SPO/NWC production support funding is identified through the NWC financial system by a seven digit customer order number. The customer order identifies the funds to the Engineering Department, the Sidewinder production support effort, and the fiscal year the funding was appropriated. Added to the customer order are three letters which define the job order (JO). Unique JO letters are established by the SPO/NWC Production Manager for each task agreement entered into with the functional codes. The JO letters are the means by which the SPO/NWC identify, track, and control the internal expenditures versus task agreement allocations.

As noted in Figure III-7, there are two processes involved; one is the NWC Code 08 financial system, which has the control of all financial processing and two, the SPO/NWC JO system which establishes the JO and task agreement from which the functional codes derive the assets to pay salaries, purchase material, etc.

Funding documents, i.e., AIRTASK, MIPR, etc., are received by Code 08 and enter the financial system. Then




FUNDING CONTROL PROCESS
FIGURE III-7

SPO/NWC, Engineering Design Division, and Engineering Department review the documents for acceptance or rejection. Once the funding is accepted, a planned budget with JOs is submitted to Code 08. This budget establishes the planning data required by NWC management for the funds received. The budgets are prepared by the Production Manager and Project Engineers based on projected task inputs from each of the functional codes involved in the particular task agreement. Format, overall policy and content are reviewed by the SPO/NWC financial assistant and SPO/NWC Manager before release. The budget documents are also signed by the division and department offices.

Once the funding documents are received, approved, and budgets prepared, the functional codes can use the funding for the performance of specific tasks. As task assignments are accomplished by the functional codes, the applicable customer order and JO are cited on timecards, requisitions, and other expenditure documents. The SPO/NWC is not involved in the functional codes timecard payroll process but does approve all other expenditure documents.

Once the charges are made against the particular customer order and JO, a report is generated which details all charges. This report is received on a weekly basis and is used by Project Engineers and Production Manager to track funds expended against various task agreements. The monthly summary is used by the SPO/NWC Manager to track expenditures

against budgeted amounts. The monthly summary is also sent to PMA-259 as a portion of the SPO/NWC monthly report.

3. Task Agreement Process

The SPO/NWC depends on the functional organization for the support necessary to fulfill the Sidewinder AIM-9 responsibility at NWC. To define the support requirements between the SPO/NWC and the functional codes, formal task agreements are established. The task agreements are the principal formal program link between the SPO/NWC and the functional code.

The task agreements are typically general in nature and define the description of work, the approach to be taken, and the estimated funding by customer order and unique JO. Appendix K is an example of a typical task agreement. As seen in the example, the approach is general and the period of performance (schedule) is continuing for one year.

The task agreements usually are established on the fiscal year and follow the budget cycle, although task agreements are established for special tasks when the estimated cost is over twenty-five thousand dollars.

Any particular detail tasks then remain to be defined and assigned in meetings, memoranda or telephone calls between the Project Engineers and the functional organization.

In summary, the task agreements perform the following functions: a) define the general resource level

required from the functional code, b) define the general description of work and approach, c) define the funding level for the functional organization with unique JOs, d) define the reporting requirements, and e) define the general schedule.

4. Mark III Management System.

The Mark III Management system is used within the SPO/NWC to visually display the Sidewinder component contracts' Master Data Program Schedules. The Mark III Management system is a computer based management system with two basic outputs available to the user: 1) direct outputs from the computer, and 2) outputs resulting from computer generated plots.

The direct outputs, i.e, listing of planning updates, listing of safety paths, etc., are not used in the Sidewinder Production Support effort and will not be discussed. The computer generated plot is used for tracking contract data items (CDI) in the AIM-9L Production Support area. Contract data items are primarily reports and plans required to be delivered by the contractor at prescribed times or intervals in accordance with the contract. These reports and plans (referred to as contract data items) are reviewed by NWC to insure compliance with the contract and technical worth.

The computer generated plot is basically a planned schedule. The plots are available in three different forms: 1) detail, 2) selective, and 3) summarization. For contract

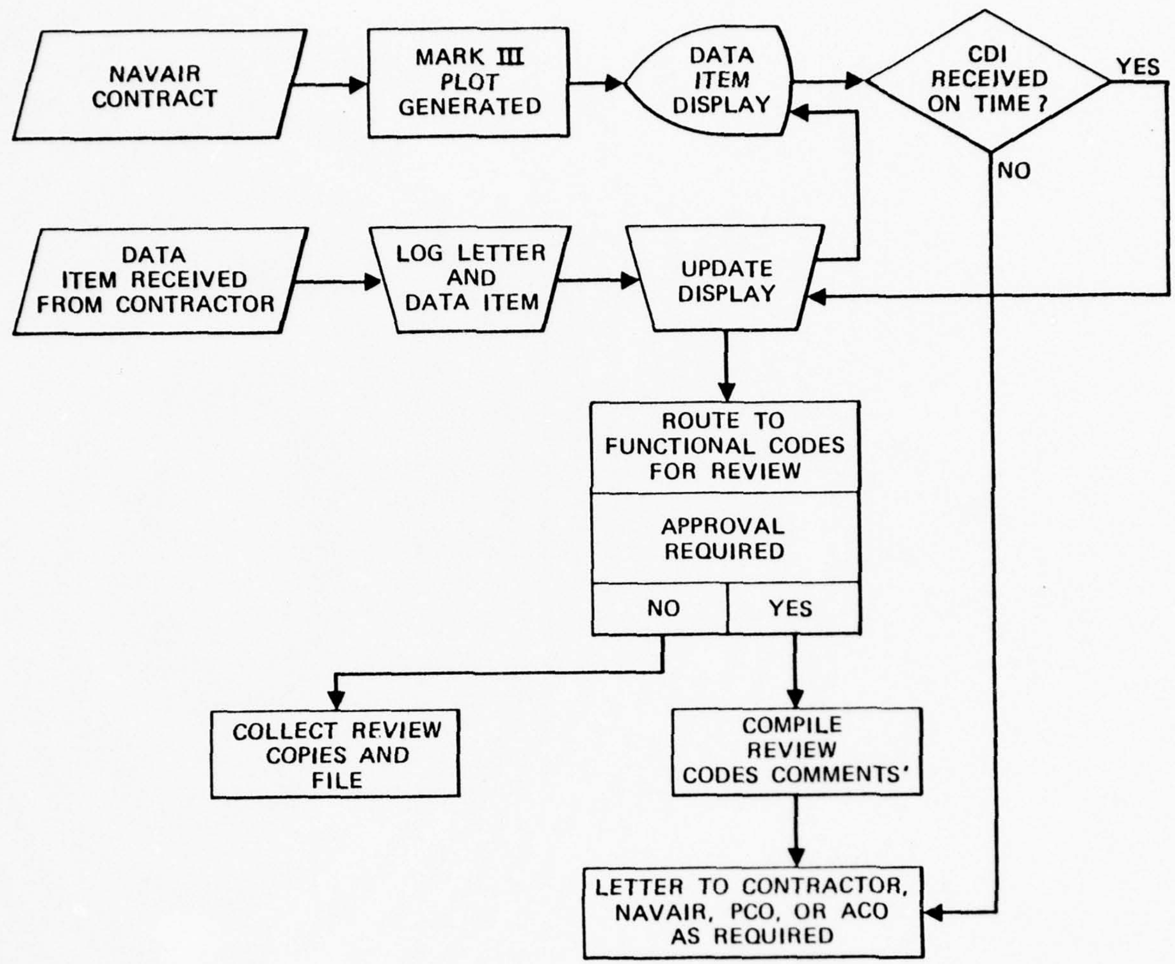
data items, the summarization form is used. The plots, one for each contract, give the activity (data item), responsible Project Engineer, and item delivery schedule for each data item. Figure III-8 is a block diagram of the flow of a data item when received by the SPO/NWC.

The data plots are used as a visual representation of the contract data item delivery dates. The incoming contract data items are checked against the contract requirements by a data clerk, and are routed to functional codes with a response date assigned by the Data Manager and Project Engineer. The data clerk tracks the response dates and compiles review notes. The Data Manager and/or Project Engineer then write a letter response as required in the specific contract.

5. Data/Configuration Management System

The configuration management responsibility within the SPO/NWC requires evaluation of Engineering Change Proposals (ECPs), establishment of product baselines, establishment and maintenance of a master documentation control center, and establishment of configuration management practices.

Plans to define data/configuration management practices and policies within NWC are contained in the Document Control Plan for the Sidewinder AIM-9H/L missile (TN 5551-1-75). The bulk of the configuration management effort is in the processing of ECPs required to control, change, and maintain the product baseline. The product




CONTRACT DATA ITEM FLOW DIAGRAM
FIGURE III–8

baseline includes all drawings and specifications used to define the AIM-9L missile. To illustrate the process involved in changing the product baseline, a flow diagram, which includes the contractor and Defense Contract Administration Service (DCAS) organization's role along with process time requirements, is shown in Appendix L. As illustrated, twenty steps are performed by the SPO/NWC Project Engineer, D/CM, Configuration Accounting personnel and appropriate functional codes upon receipt of an ECP by the SPO/NWC. These actions require about 20 working days to accomplish. The SPO/NWC receives anywhere from 20 to 50 Class II ECPs a month which are processed within the SPO/NWC by the D/CM and two data clerks.

Processes similar to those shown in Appendix L are required for a Class I ECP with the exception that NAVAIR has final approval/ disapproval authority. Once production deliveries have started; however, only four to five Class I ECPs are received each month so they have a small impact on the overall workload.

6. Periodic Reports

There are four formal periodic reports required from the SPO/NWC in conjunction with the AIM-9L Production Support effort. The NAVAIR program status report and the visit action report are each required on a monthly basis. Reports to NWC management consist of the NWC Management Program Status Report (monthly), and the NWC Weekly Program Highlight Report.

The monthly NAVAIR report, the most comprehensive of the reports, includes a detailed technical status of each functional discipline of the program with corresponding funding status. The technical status is compiled by the Project Engineer from monthly reports submitted by the functional codes. The funding status is compiled from the detail Code 08 computer summary. The monthly status reports submitted by the technical codes are received by the SPO/NWC ten days after the end of the report month. The Project Engineers then integrate these reports and submit the draft NAVAIR report to the SPO/NWC Manager. The report is normally mailed to NAVAIR by the end of the month following the report month.

The NAVAIR visit action reports are used to provide information to NAVAIR on NWC personnel's trips to missile component manufacturers' facilities. There are an average of twenty visit action reports prepared per month. The reports are prepared by the traveler, collected by the SPO/NWC and transmitted to PMA-259 by official letter.

The NWC internal management reports are prepared by the Production Manager and Project Engineers. The funding data is summarized from the same data as the NAVAIR reports and the technical aspects are short comments on significant problems and/or accomplishments, prepared by the Production Manager and Project Engineers, with less detail than the NAVAIR reports. The NWC internal management reports are of two types: 1) a NWC Commander's report prepared on a monthly

basis, and 2) an Engineering Department Head (Highlight) report prepared on a weekly basis. The Highlight report contains more technical progress and problem details and does not contain funding data.

7. Program Review Action Items

Formal program reviews between Navy and component contractors personnel are held on a periodic basis. The reviews are program production related with program status and problems the primary agenda. The results of these reviews are formal and semi-formal minutes with action items assigned by the Infrared Missiles Program Manager or Assistant Program Manager (APM) to the contractor, NAVAIR functional personnel and/or NWC. The SPO/NWC has the responsibility to see action is taken on all items assigned to NWC.

The process followed to ensure action item accomplishment depends on the responsible Project Engineer and the priorities he assigns to program review action items, the type of personnel available within the functional codes to respond to his requests, his ability to persuade the functional personnel, etc. There is no formal process established and each Project Engineer uses his own system to assign, track and report status of program review action items.

The volume of action items resulting from any given status review meeting is highly variable. For example, the number of action items from two consecutive GCS contract status review meetings was from four to sixty-two. With an

average of one status review meeting per month, this would be an average of thirty-three action items SPO/NWC Project Engineers must delegate to functional codes, track and report status on per month.

# IV. SIDEWINDER PROGRAM OFFICE (NWC) MICS REQUIREMENTS

## A. BACKGROUND

To this point, the authors have stated the problem of program planning and control as it exists at the SPO/NWC. The problem has been presented in general terms and with current literature viewpoints on the managerial functions of planning and control and MICS considerations. In addition, they have detailed the current environment of the SPO/NWC, and the systems currently used to provide information for planning and control purposes. The previous chapters, therefore, represent the first two phases of the MICS system life cycle as presented in Chapter I. This chapter will address the elements of the third phase in the life cycle - the Requirements Phase. The roles, responsibilities and information flows described in Chapter III will be considered in terms of concepts and considerations presented in Chapter II in order to arrive at meaningful system requirements for a MICS to support the needs of SPO/NWC. The information and control systems currently in existence at SPO/NWC will be evaluated in light of these systems requirements in order to determine the adequacy of their performance. The result of this review and evaluation process will be a gross MICS design for the SPO/NWC.

This requirements determination activity, as outlined by Rigo, is nothing more than the design process as discussed in Chapter II. As previously presented in that chapter,

Dr. Wilkinson contends that the appropriate design process is dictated by the perspective taken with respect to the MICS. The authors contend that the appropriate perspective for the SPO/NWC MICS is that of a decision-oriented network and therefore the appropriate design approach is one of defining the required outputs and working backwards to specify the input data and conversion processes necessary. This contention is made based upon the assumption that the information needed within the SPO/NWC for the successful accomplishment of the majority of their responsibilities can be provided by regularly scheduled reports. This basic assumption will be verified as the requirements determination/design process is executed in this chapter, with the exception of specific instances which will be indicated.

In executing the design process in this chapter the authors will use a modified Burch and Strater approach. The initial effort will be the definition of the desired SPO/NWC MICS goals and objectives. The current systems will be evaluated in terms of their ability to meet these goals and objectives. This will be followed by the development of a conceptual model of the desired system and the definition of required outputs. Finally, the necessary inputs and processing will be addressed.

## B. SPO/NWC MICS GOALS AND OBJECTIVES

It can be seen that the roles and responsibilities of the personnel within the SPO/NWC, as described in Chapter

III, fall into the categories of operational control and managerial control in the Anthony framework. The Project Engineers are responsible for assuring that specific tasks are carried out within their areas of cognizance. The Production Manager and the SPO/NWC must coordinate and plan to assure that resources are obtained and used effectively and efficiently in the accomplishment of the program objectives. In general, it can be stated that the goals of the SPO/NWC MICS are to provide operational control at the Project Engineer level, and managerial control at the Production Manager and SPO/NWC Manager level. The adoption of this perspective allows, perhaps even requires, the use of the information and MICS characteristics and considerations appropriate to these categories in the design process of the SPO/NWC MICS. Within these two general MICS goals of operational and managerial control are various objectives which will be discussed in the following sections.

1. Operational Control

The first objective of the operational control aspect of the MICS is to provide a "closed-loop" task tracking system. Koontz and O'Donnell state that "the basic control process, wherever it is found and whatever it controls, involves three steps: 1) establishing standards, 2) measuring performance against these standards, and 3) correcting deviations from standards and plans."[10] This description implies a "closed-loop" system whereby information is fed back to the manager in order for him to measure

actual performance against established standards. The objective of the task tracking system is to provide a mechanism for the recording of tasks to be accomplished, and a means of identifying those tasks which have been completed and those which have not in order for the Project Engineer to take appropriate action.

A second objective of the operational control subsystem is to provide a uniform or standardized method and format for the tracking of tasks within the SPO/NWC organization. One of the problems described in Chapter I was the lack of uniformity among the individual Project Engineers' methods of task tracking which results in considerable confusion and research effort when these individuals are absent or rotated. The establishment of a single format or method would allow for timely and orderly retrieval of information in the absence of any particular individual and allow for reduced training among Project Engineers in the event of position rotation.

A third objective of the operational control subsystem is funding visibility at the JO level. In addition to monitoring task accomplishment in terms of schedule and performance, the Project Engineers should be able to track expenditures on tasks being performed within the functional codes and PFAs as appropriate.

A final objective of the operational control portion of the MICS is the ability to provide operational information for historical purposes. One of the elements of

the first operational control objective (closed-loop task tracking) was the identification of the actual accomplishment of an assigned task. While the primary use of this information is to highlight the remainder of the tasks, i.e., to identify those tasks which have not been completed, an equally important aspect is the ability to produce proof of task accomplishment and provide the informational results of the task completion at some point in the future. The MICS must include this capability in order to adequately support the SPO/NWC operations.

2. Managerial Control

In order to exercise effective managerial control, the decision maker must have visibility into the resource areas which he is attempting to manage. The first objective of the managerial control subsystem of the MICS is to provide visibility into the SPO/NWC organization itself. The Production Manager and SPO/NWC Manager must know which responsibilities or tasks are not being fulfilled so that they may bring additional resources to bear if required. This can be accomplished by an overdue task reporting system. This system would be an exception reporting system by nature and would identify those specific areas which require managerial attention.

The second objective of the managerial control subsystem is visibility of external areas essential to the accomplishment of program tasks and objectives. These areas include the functional codes within NWC and other activities

which interact with SPO/NWC, as outlined in Chapter III. The Production Manager and SPO/NWC Manager have a need to know the level of workload within these activities in order to make appropriate resource allocations and tradeoffs in light of program goals. The level of workload intended here would reflect only SPO/NWC tasks to be performed by these activities. This visibility would allow the Production Manager and SPO/NWC Manager to establish priorities among the various SPO/NWC tasks which a particular activity was to perform in the face of limited resources within that organization, or to request and/or provide additional resources for the completion of critical tasks.

In addition to the level of workload within the supporting activities, the SPO/NWC Manager needs to know the level of funding and expenditures as applicable to the tasks performed by these activities. This visibility would only be required at the customer order level; however, it would be very important in providing insight to resource utilization and progress of task accomplishment.

A final objective of this managerial control element of the MICS is the recording and processing of historical task accomplishment data for planning purposes. This capability would enable the SPO/NWC Manager to plan future workload and funding requirements by providing such information as the average task processing time by component area by a particular functional code. Another example would

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DESIGN CONSIDERATIONS AND CRITERIA FOR A MANAGEMENT INFORMATION--ETC(U)
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be the average cost per task by component area by a functional code. This would be particularly helpful and applicable in the processing of ECPs and CDIs. While no model is envisioned which would predict with extreme accuracy the cost and time parameters of a particular future task, the analysis of historical data would provide some insight into future resource requirements.

## C. EVALUATION OF CURRENT INFORMATION AND CONTROL SYSTEMS

### 1. Operational Control

The goals and objectives of an MICS were enumerated in the previous section of this chapter. The operational control objectives as established are: 1) a closed-loop task tracking system, i.e., a means to identify tasks that are completed or not completed, 2) a uniform method and format for task control, 3) funding visibility at the JO level, and 4) a record of completed task data.

Evaluation of the current MICS against these objectives highlights the deficiencies or adequacies of present practices. The results of this analysis will indicate the problem areas that need improvement and point out areas that must be dealt with if development of a new system is necessary.

A closed-loop task tracking system is the number one objective of the SPO/NWC MICS. Neither the correspondence, filing and distribution system, the task agreement system, nor the program review action item system provide

the closed-loop system desired. None of these systems, as structured, provides the visibility to ascertain if requested action has been completed.

The D/CM system, Mark III Management System and funding system individually possess the characteristics of a closed-loop system. The major problem is that they do not tie back into the correspondence system and therefore provide a closed-loop only on a subsystem level. In addition, these systems require manual updating and information retrieval and subsequently are very time consuming. Since they do not provide due date sequencing or exception data, this type of information must be retrieved by a search through the entire file.

As is evident in the discussion of the existing SPO/NWC information and control system in the preceding chapter, the existing system is made up of a number of disjointed systems. There is no uniform method and format for task control. Each of the existing systems is designed to perform information and control functions in specific areas and does not attempt to integrate the information into a single format at either the operational or managerial levels. As a result, a Project Engineer, the Production Manager, and/or the SPO/NWC Manager must go to three or four different reports or files to determine the status of work under his cognizance. The time required to accomplish this is considered excessive.

The individual Project Engineers keep their own personal tracking system of notebooks or chalkboard entries, each with his own format. This makes tracking or interpretation of status difficult in the absence of one of these individuals. The absence of a predetermined format and system for: 1) program review action item, and 2) miscellaneous requests for task accomplishment, which do not fall into one of the predetermined categories in existence results in the loss of data connected with the completion of these tasks. In fact, some of the requests probably do not ever get accomplished and are never brought to light since there is no system to record and track their progress.

The funding process at the JO level is adequate in that a system is available for SPO/NWC use. However, as it is being used, it does not provide the cost-performance tracking of tasks at a level that the Project Engineer needs. The mechanism exists but the implementation is lacking. The lack of cost visibility at the JO level is a problem in each of the current MICS systems. D/CM and Mark III systems have JO control but it is at such a level that the expenditures for any given ECP review are unknown and only averages can be determined. A similar situation exists with the program review action items in that all expenditures for all items in a functional code are charged against a general task agreement and no visibility is provided on any particular action item task.

### 2. Managerial Control

The managerial control objectives of the desired SPO/NWC MICS are: 1) visibility into the SPO/NWC organization, 2) visibility into external areas, 3) expenditures level summaries, and 4) historical summaries on completed tasks. Analysis of the current MICS in light of these objectives will determine the adequacies or deficiencies of the current practices.

The current information and control systems, with the exception of the funding, do not provide managerial visibility into the SPO/NWC. Neither the correspondence and filing system, D/CM system, program review action item system, nor Mark III system provide, on a scheduled basis, any data on past due or delinquent tasks. This type of past-due tasks information can be located in D/CM card files but it is not readily available.

A similar situation exists with visibility into the SPO/NWC functional support organization. The current information and control systems do not provide any type of exception reporting or workload levels. Visibility is available through the monthly technical reports on past performance only. There is no means to highlight workload difficulties and therefore allow the SPO/NWC to set priorities or reallocate resources.

The current funding system provides adequate reporting on the financial status of the program at the customer order level.

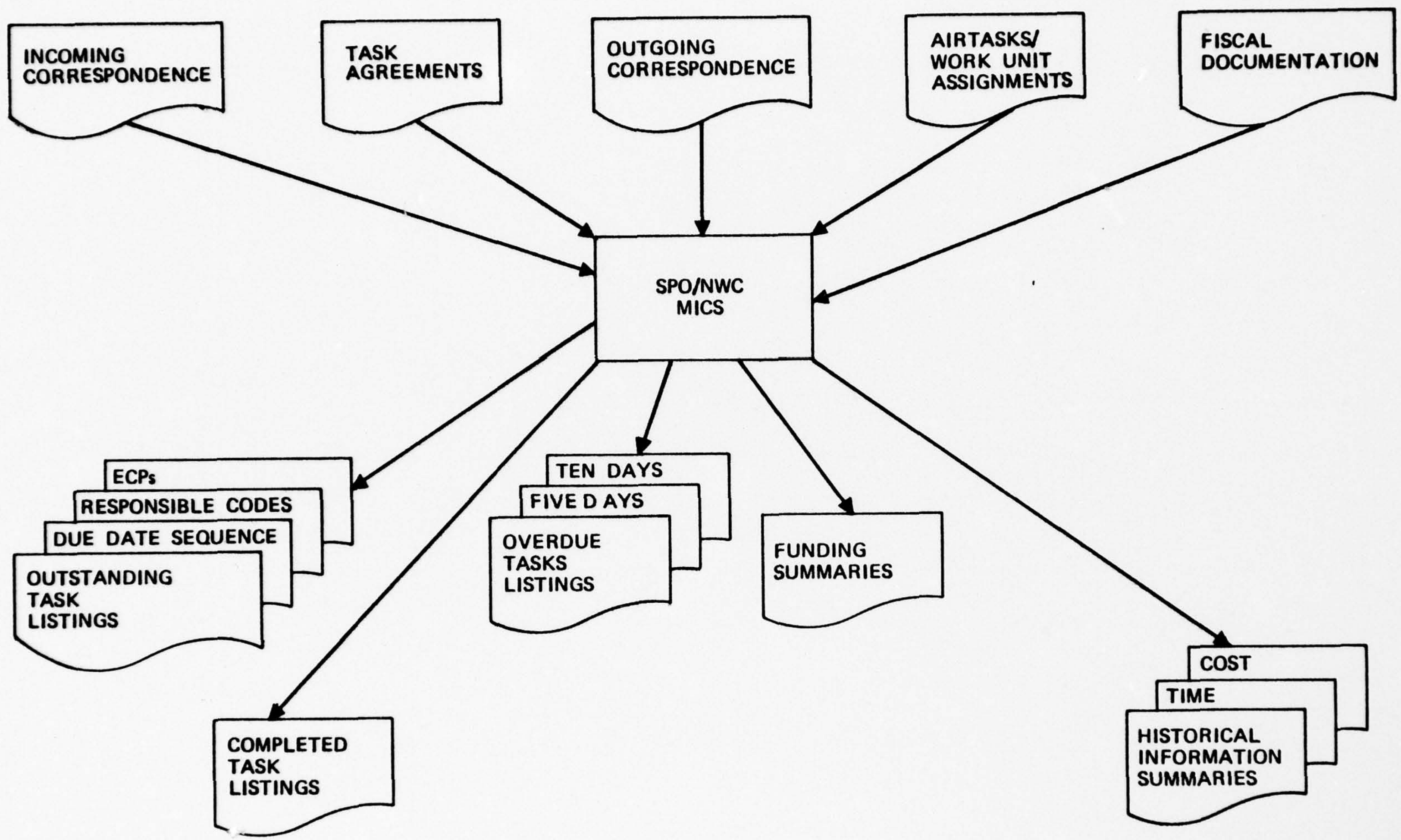
Historical file data using the current information and control systems is deficient in that there is no central file system to retrieve information on past-due tasks. Historical data must be retrieved manually from a diverse number and type of files, and subsequently manipulated by hand to produce the desired information.

3. Summary and Conclusions

The evaluation of current information and control systems, in light of the goals and objectives established by the authors, highlights deficiencies in the following areas: 1) closed-loop tracking, 2) uniform format/methods, 3) management visibility, and 4) historical filing. In order to eliminate these deficiencies, the authors will present a conceptual model of a MICS for the SPO/NWC.

## D. SPO/NWC MICS CONCEPTUAL MODEL

The conceptual model of the desired SPO/NWC MICS is primarily a pictorial or diagrammatic presentation of the system inputs and outputs. The system inputs are the various means of task and responsibility assignments discussed in Chapter III. The outputs consist of reports designed to attain the system's overall goals and objectives as discussed in the previous section. The conceptual design model of the SPO/NWC MICS is presented as Figure IV-1.




CONCEPTUAL DESIGN MODEL OF SPO/NWC MICS

FIGURE IV–1

## E. DEFINITION OF SYSTEM OUTPUTS

This section will discuss in detail the outputs shown on the conceptual design model. Each report will be outlined in turn, depicting the specific information fields required to prepare the output, the retrieval time and frequency needed, the volume of information to be reported, and the number, dissemination, and output security involved with each.

### 1. Outstanding Tasks Listing

As described in the previous chapter, the Project Engineer is a very key individual in the accomplishment of SPO/NWC responsibilities. Correspondence goes directly to the appropriate Project Engineer, via the "programmed" correspondence distribution system. He is responsible for the assignment of tasks to the functional codes and other activities and the monitoring of progress on the task completion. A viable, comprehensive MICS must provide the Project Engineer with an improved capability to discharge his responsibilities. The purpose of the outstanding tasks listing is to assist the Project Engineer by providing a uniform and comprehensive means by which each task assigned to NWC functional codes and other activities may be tracked.

In order to accomplish this, the listing must contain the subject of the specific task, the responsible code or activity name, the completion due date, the task initiating documentation, and the form of the required reply. This information will allow the Project Engineer to

keep track of what the task is, who is responsible for completion, and when completion is required. It also indicates who or what activity requested the performance of the task and what the desired response is to be, i.e., a report, letter, memorandum,presentation, etc. The output report should also contain an entry indicating the amount of funds budgeted or expected to complete the task and the amount actually expended as of the report date. This funding should be broken down into labor, material, travel, overhead, and "miscellaneous" categories. This will enable the Project Engineer to monitor costs concurrently with the schedule and performance parameters.

As a means of organizing the multitude of tasks which are to be tracked by each Project Engineer, four categories should be delineated. There would be ECPs, CDIs, Program Review Action Items and other tasks. All the information items desired above should be included on specific tasks within each of these four categories. In order to act as a "tickler" to the Project Engineer, the information items listed above should be presented in due date sequence within the four categories. This will enable the Project Engineer to see delinquent tasks readily, as well as those on the immediate time horizon.

In addition to the due date sequence listings within the four task type categories, a report is also needed, arranged in responsible code or activity sequence. The information fields would be the same as those in the due

date report; however, this listing would highlight the workload in the functional codes and other activites as well as the schedule and cost performance of these activities.

The Outstanding Tasks Listing in due date sequence would be tailored to each Project Engineer, i.e., each Project Engineer would receive a listing showing the tasks in his area of cognizance (GCS, AOTD, etc., as applicable.) In addition, the D/CM would receive an aggregate listing of all ECPs to enable him to ascertain those ECPs which were late in the review cycle and those which were nearing the due date. The responsible code or activity report would be provided to the Production Manager and SPO/NWC Manager to give them the visibility into the activity's workload levels and enable them to set priorities, make resource allocations, and determine if new tasks can be accepted. It could also be provided to the functional code heads to give them a summary of SPO/NWC work to be performed by their organization.

A review of the volume of tasks outstanding indicates that approximately 120 items are outstanding each month in the area of AIM-9L production support. These items are divided among the four Project Engineers under the Production Manager. In order to adequately monitor these tasks, the Outstanding Tasks Listing should be provided to the Project Engineers on a weekly basis, and the information provided shall not be more than seven days old. The responsible code or activity report should be provided to the

Production Manager and the SPO/NWC Manager every two weeks and should not present information more than seven days old.

2. Overdue Tasks Listing

The Overdue Tasks Listing would provide the Production Manager and SPO/NWC Manager with visibility into the SPO/NWC organization itself and highlight those areas which require managerial attention. The information provided would be the same as presented in the Outstanding Tasks Listing; however, only those unaccomplished tasks which had surpassed the completion date would be listed. The Production Manager would receive a weekly listing showing all tasks overdue by five or more days and the SPO/NWC Manager would receive a weekly listing showing all tasks overdue by ten or more days. Both of the reports would be in due date sequence; however, the cognizant Project Engineer and functional code would also be listed so that dissemination of this report should be restricted to the Production Manager and SPO/NWC Manager only.

3. Completed Tasks Listing

The purpose of the Completed Tasks Listing is to provide a record of task accomplishments and thereby close the loop which was begun upon the receipt of a request for task accomplishment. In addition, it would provide a data base for projections of future requirements and capabilities. The basic information elements which were established by the Outstanding Tasks Listing would be retained on the Completed Tasks Listing and the completion date, outgoing

response identification number (e.g., letter serial number message date-time group), total costs, and time to complete the task would be added. This listing should be arranged in incoming requestor documentation identification number sequence in order to tie specific responses to specific requests. This would enable SPO/NWC personnel to retrieve the requested information at a later time through the use of the original requestor identification number.

Only one listing would be required and should be provided on a bi-weekly basis. It should contain the accumulation of up to the previous six months information. After the accumulation of six months information, the last listing would be retained and a new cumulative listing would be initiated. Based upon the average number of tasks outstanding, it is anticipated that in a six-month period approximately 750 task accomplishments would be recorded.

4. Historical Information Summaries

The planning and estimating for future workloads and tasks is an important element of the SPO/NWC Manager responsibility. With the application of many years of experience and by repeating similar tasks, the planned details become more accurate in terms of cost, schedule and performance. However, when personnel change, the corporate memory is lost and another training period begins.

The data base established by the Completed Tasks Listing would retain the needed task accomplishment data. This data could be manipulated to produce information on an

"as required" basis to furnish the SPO/NWC Manager with such outputs as average time and/or cost for task completion of a certain type by a given functional code or PFA. This type of information could be used to answer "what if" questions and also to evaluate the efficiency of a particular functional code or PFA.

5. Funding Summaries

Funding summary reports are essential to provide the fiscal information necessary to manage the SPO/NWC. Funding reports for the managerial level should include funding received by NWC, planned expenditures, actual expenditures, and cumulative expenditures for the fiscal year by customer order. A further breakdown of actual expenditures into labor, overhead, material, travel, contracts and miscellaneous should be included. The reports should be available on a monthly basis. This will allow program visibility in time to avoid over expenditures.

The number of reports would be small since only one copy per customer order number is required. AIM-9L production support would have only one report per month.

The report should be disseminated to the SPO/NWC Manager and the Production Manager. The fiscal assistant would keep and maintain file copies. The same report could then be used for NAVAIR and NWC management reports.

The summary funding reports would provide a means to track and control expenditures at the managerial level.

It would be available for upper management reports and should not require any output security restrictions.

## F. DEFINITION OF PROCESSING REQUIRED

Having determined the characteristics of the outputs required by the desired SPO/NWC MICS, it is possible to provide a general set of requirements for the processing function of the system. As described in Chapter II, the processing functions can be viewed in terms of response time, frequency, data volume, data manipulation and storage or file requirements.

The frequency of the output required and the currency of the information desired will affect the response time and frequency of the processing operations. In order to provide weekly listings with information less than seven days old requires a system processing time of one day. The response time of the processing function must, therefore, be one day. However, the frequency of the update would be weekly. Those reports which are required bi-weekly would result in an update frequency of bi-weekly with a processing response time of one day in order to provide information with a currency of seven days. Similarly monthly reports would require monthly updating. The "as required" reports would not require as immediate a response time. Three days would be sufficient to respond to most "what if" questions and since the information would be historical, there would not be any strict restrictions in the currency of the data.

The data volume would be dependent upon the number of tasks assigned during the period and the amount of data recorded for each task. The number of tasks has been previously estimated at 120 per month, and the information fields required were enumerated under the discussion of the Outstanding Tasks Listing and the Completed Tasks Listing.

The storage or file requirements would be determined by the volume characteristics described above, the number of variations of the basic reports required, and the length of time for which the data must be retained. The Outstanding Tasks Listing has three variations: the due date sequence listing, the responsible activity listing and the aggregated ECPs listing. The Overdue Tasks Listing would be provided in two variations. The Completed Tasks Listing would be a single listing with no variations. The funding summaries would require arrangement of the data by customer order. The Historical Information Summaries would require the arrangement of the completed task data by functional code or PFA and subject category to enable future processing to provide the desired information. The number of files actually required to provide the data outputs represented by the various reports, will be dependent upon the data processing method selected for the MICS. A manual or electromechanical method would require separate files for each. An EAM or punched card equipment method could use a single or small number of card files and merely re-sort them each time a new variation of output is required. An electronic computer

could utilize separate file storage or a data base storage system as deemed appropriate.

The outstanding tasks data would be changing constantly over a period of time but would retain approximately the same volume level as previously indicated. The completed tasks data would be retained in a file arrangement for six months; therefore, the file would contain about 750 tasks.

Processing operations would be required to provide the listings as described in the output definition section. These could be done manually or with machine and the extent of processing would be determined by the number and type of files maintained. Obviously, if a separate file were maintained for each type of report, no processing would be required other than compiling the information into a report itself. The Historical Information Summaries would require calculation of average cost and time. Also, calculation of ranges of values or variances, and standard deviation from the mean values could be required.

## G. DEFINITION OF INPUTS REQUIRED

The input sources for the desired SPO/NWC MICS are shown in the Conceptual Design Model (Figure IV-1). The primary personnel to actually input data to the system would be the Project Engineers. Upon receipt of a task assignment, the appropriate Project Engineer would fill out a formatted input data sheet with the required information. This basic document would then become the instrument for

taking the transaction up in the MICS. Updating would also be done by the Project Engineer; however, the insertion of the completion data indicating task accomplishment could only be done by the Production Manager or SPO/NWC Manager. Verification of input data would be required before allowing the data to enter the MICS.

# V. CONCLUSIONS AND RECOMMENDATIONS

## A. SUMMARY

This thesis represents a comprehensive review of the current literature on MICS theory and applications, and a thorough review of the current SPO/NWC organization and MICS by the authors. Goals and objectives for a viable SPO/NWC MICS were established in light of the theoretical management practices appropriate, and the needs of the SPO/NWC. An evaluation of the current SPO/NWC information and control systems was made with respect to the established MICS goals and objectives, and the current systems were found to be deficient as noted in the preceding chapter. An improved MICS was therefore deemed necessary by the authors, and a conceptual model was presented representing a viable, comprehensive MICS for the SPO/NWC.

## B. CONCLUSIONS

The authors concluded in Chapter IV that the current SPO/NWC information and control systems failed to meet the desired performance in the areas of operational control and managerial control. Specifically, deficiencies were noted in the areas of closed-loop task tracking, uniform format/methods, management visibility, and historical filing. In order to eliminate these deficiencies, a conceptual model of an improved MICS was presented. The alternatives to

providing an improved MICS are the redesign or revision of the current MICS, or the design of a totally new MICS structure.

## C. RECOMMENDATIONS

### 1. MICS Revision and Augmentation

It is the authors' recommendation that the present MICS be revised and augmented. Design of a totally new MICS structure is not considered necessary. The revision of the existing systems would adapt the adequacies of existing systems to the characteristics of the conceptual model, and the augmentation of currently lacking capabilities would provide the feedback and visibility required.

What is envisioned is an integrated MICS utilizing the existing systems' structures but introducing a common, uniform, input documentation to provide a single means of tracking and recording task accomplishment within the existing systems. These existing systems would then become subsystems of the integrated MICS. This approach would utilize the existing adequacies of these current methods and would assist in providing the added operational and managerial control required.

The introduction of a feedback mechanism to produce a closed-loop task tracking system would provide the information required for adequate operational control and managerial control. This information would then become the

basis for the reports previously described which are not available under the current system.

2. Data Processing Method

The data processing method required for this integrated MICS could be any of the four methods discussed in Chapter II; however, the authors recommend that either an EAM or computer method be investigated for application. This recommendation is based upon the volume and time constraints represented within the conceptual model, as outlined in Chapter IV.

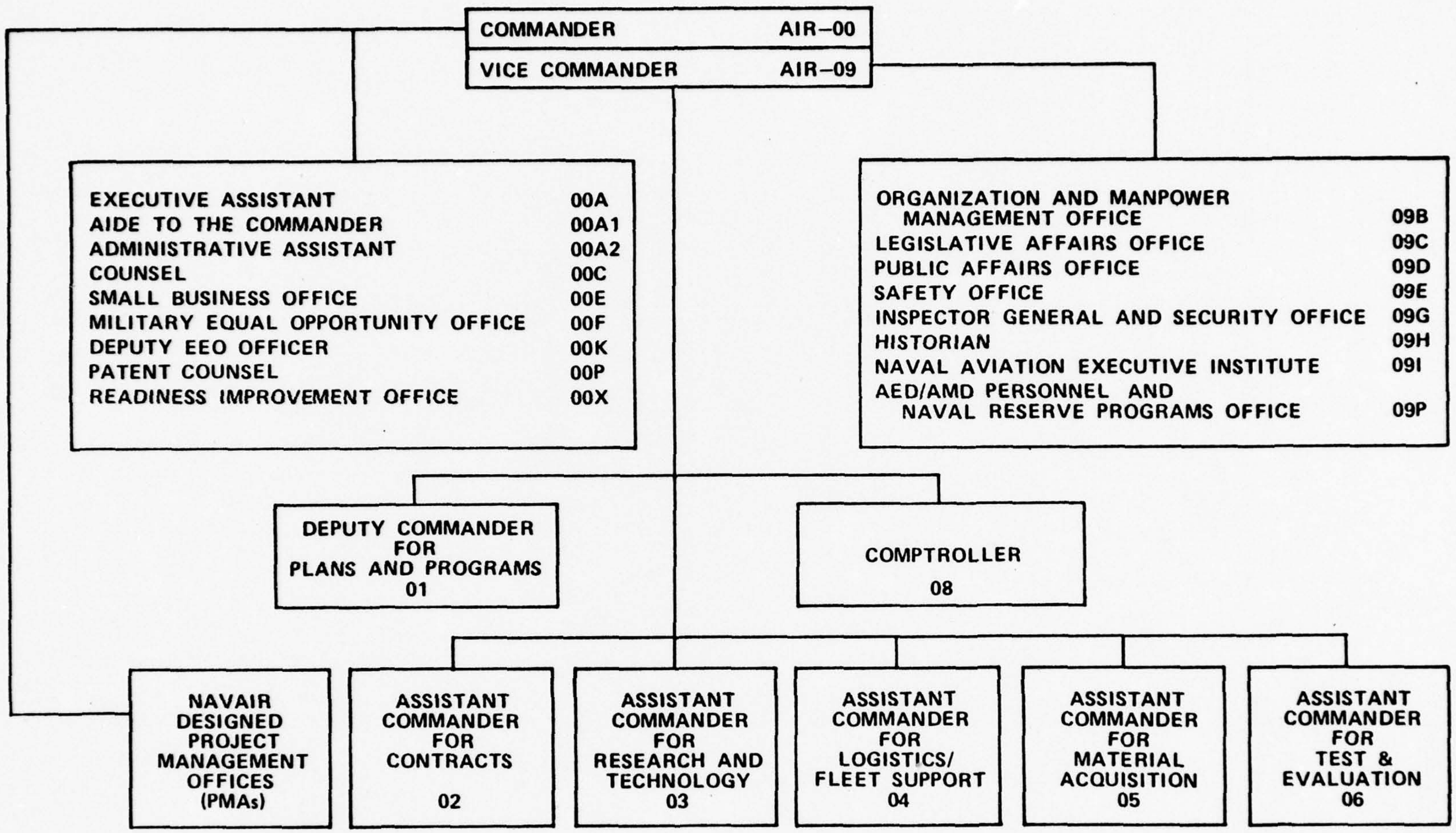
3. Participatory Management and Design

As pointed out in Chapter IV, the Project Engineer is a principal benefactor and key individual in the initiation and updating of information in the MICS. It is therefore recommended that these individuals be participants in the subsequent design and implementation of an improved MICS as advocated by the authors. Any MICS can only be effective if all concerned understand it and use it to its fullest advantage.

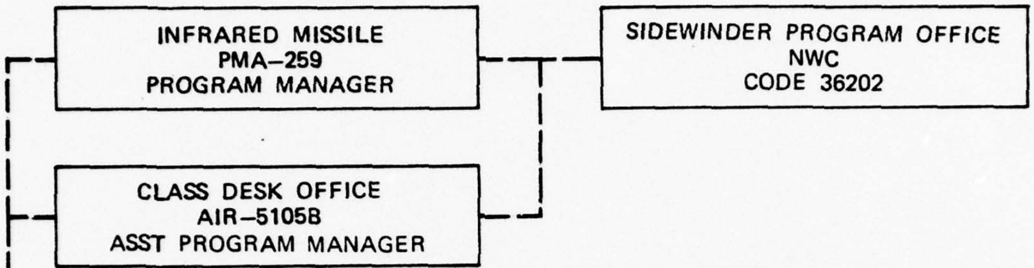
4. Follow-on Study

As noted in the Methodology section of Chapter I, this thesis represents the first three phases of the MICS development cycle. It is recommended that a follow-on study be conducted in accordance with the MICS Development Model to complete the Preliminary Design and allow the SPO/NWC to actively pursue the total design, development and implementation of the required MICS.

## APPENDIX A
## NAVAIR ORGANIZATION

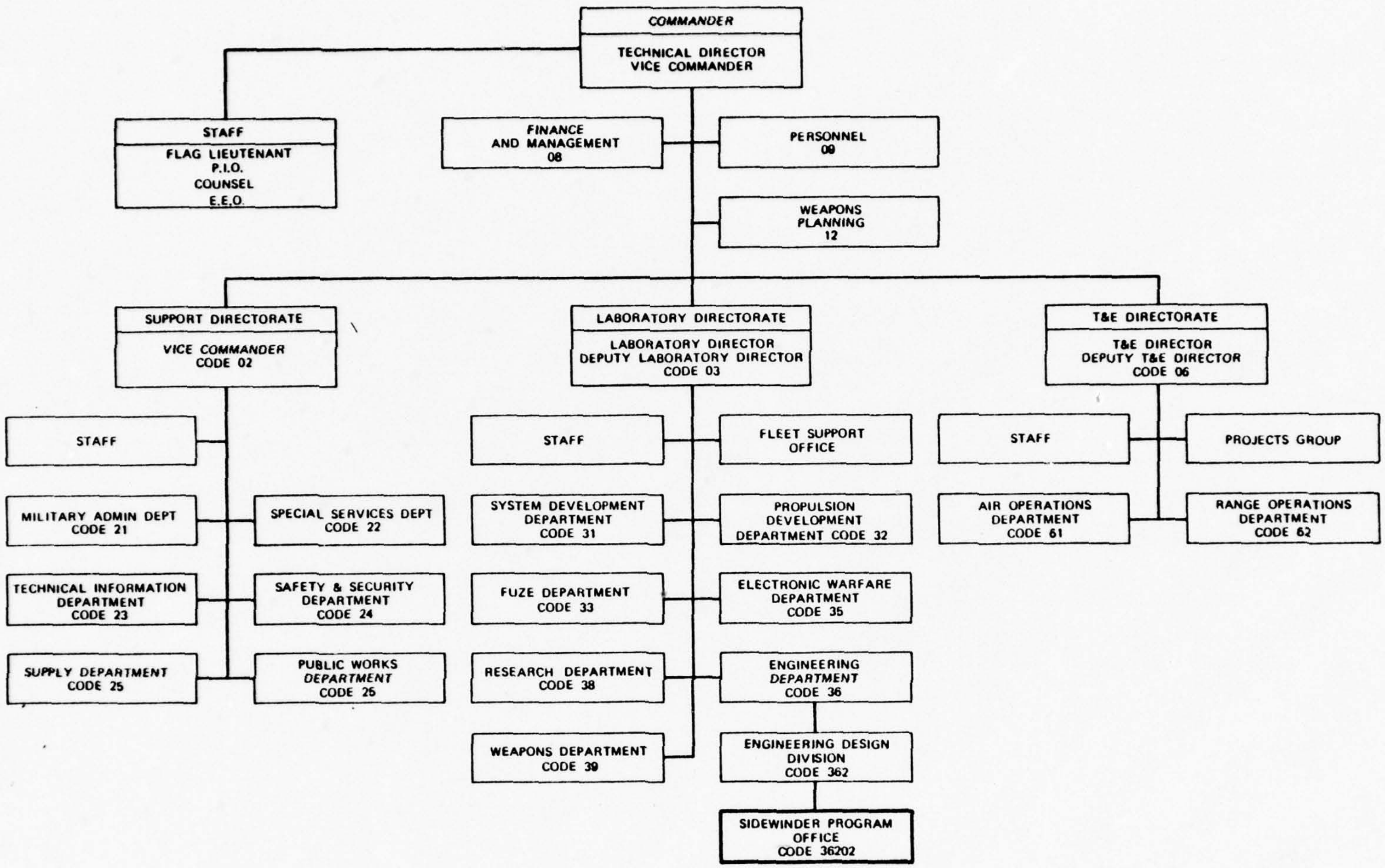


## APPENDIX B
## NAVAIR–NWC SIDEWINDER PROGRAM INTERFACES

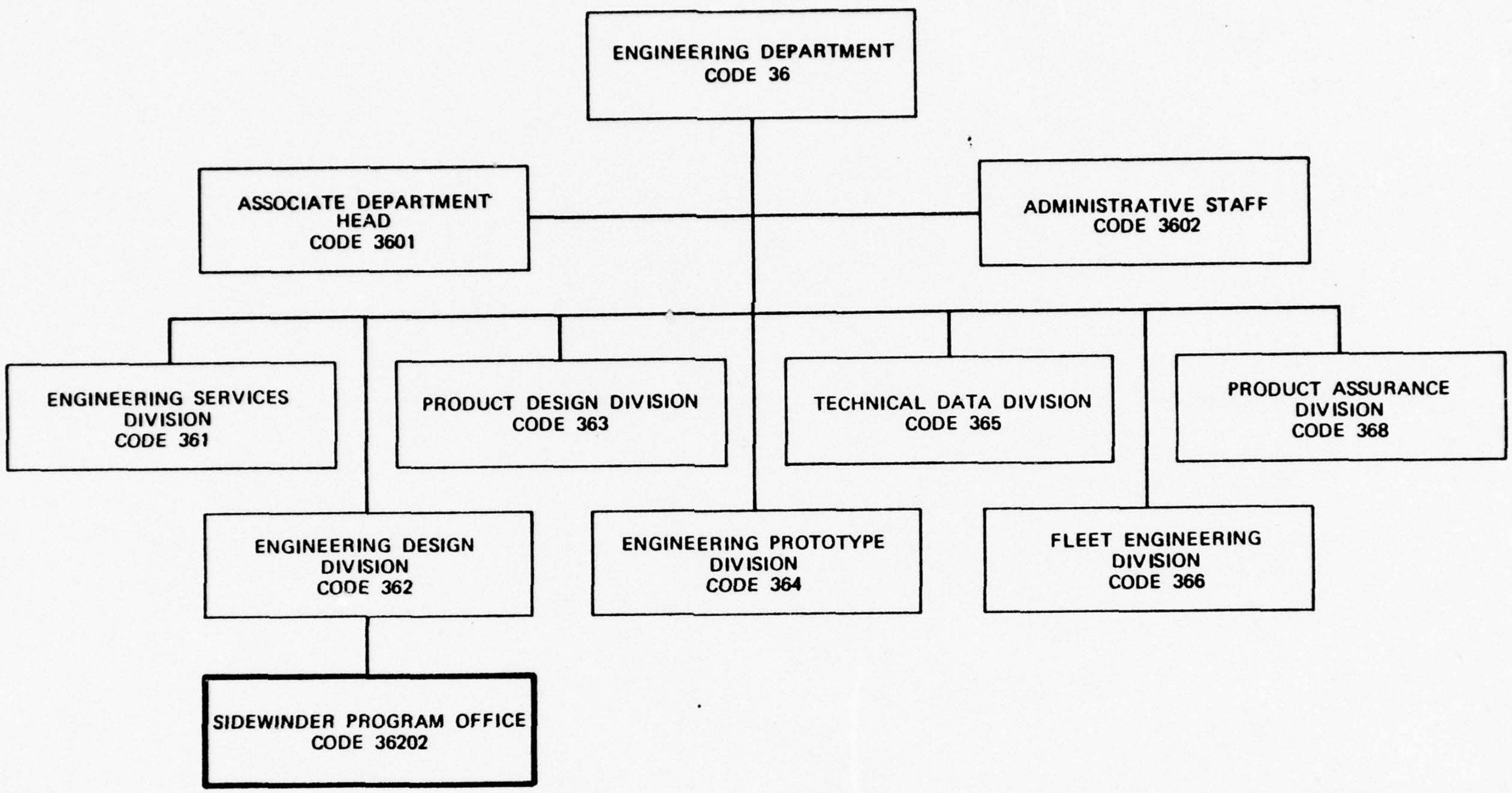



| | |
|---|---|
| PROJECT ENGINEER | AIR–5105B1 |
| PROJECT OFFICE | AIR–5105B2 |
| CONTRACTING OFFICER | AIR–21611 |
| CONTRACT SPECIALIST | AIR–21611J |
| LOGISTICS | AIR–41041A |
| MATERIAL MANAGEMENT | AIR–4122B2 |
| TRAINING EQUIPMENT | AIR–4135C |
| NARF WORKLOAD SCHEDULE | AIR–4144E |
| GSE LOGISTICS | AIR–41721C |
| CONTRACT PRICING | AIR–50632 |
| HERO/SAFETY | AIR–52024 |
| HERO/SAFETY | AIR–52024A |
| RELIABILITY | AIR–52051 |
| RELIABILITY | AIR–5205/ESA–1154 |
| AERODYNAMICS | AIR–530113 |
| LAUNCHER POWER SUPPLY | AIR–53211B |
| LAUNCHER | AIR–53212 |
| 9H/L S&A, FUZES | AIR–53241 |
| 9L S&A, FUZES | AIR–53241B |
| WARHEADS | AIR–53242A |
| 9H/CHAP–GCG, WINGS, FINS | AIR–533313A |
| 9L–GCS, WINGS, FINS | AIR–533323C |
| LAUNCHER TEST EQPT | AIR–53441C |
| MISSILE TEST EQPT | AIR–53441B |
| HANDLING EQUIPMENT | AIR–53443 |
| CONTAINERS | AIR–53443C |
| MOTORS, GAS GENERATORS | AIR–53663C |
| SHIP INSTALLATIONS/ AIRCRAFT SUPPORT | AIR–53712 |
| QUALITY ASSURANCE | ESA–11123 |
| PRODUCTION | ESA–2041D |
| PRODUCTION | ESA–2041D1 |
| PRODUCTION | ESA–64 |
| COST DATA | ESA–2083B |
| PROCUREMENT BUDGET | ESA–2012A |
| PRODUCTION SUPPORT | ESA–61A |
| LEGAL COUNSEL | AIR–00C |

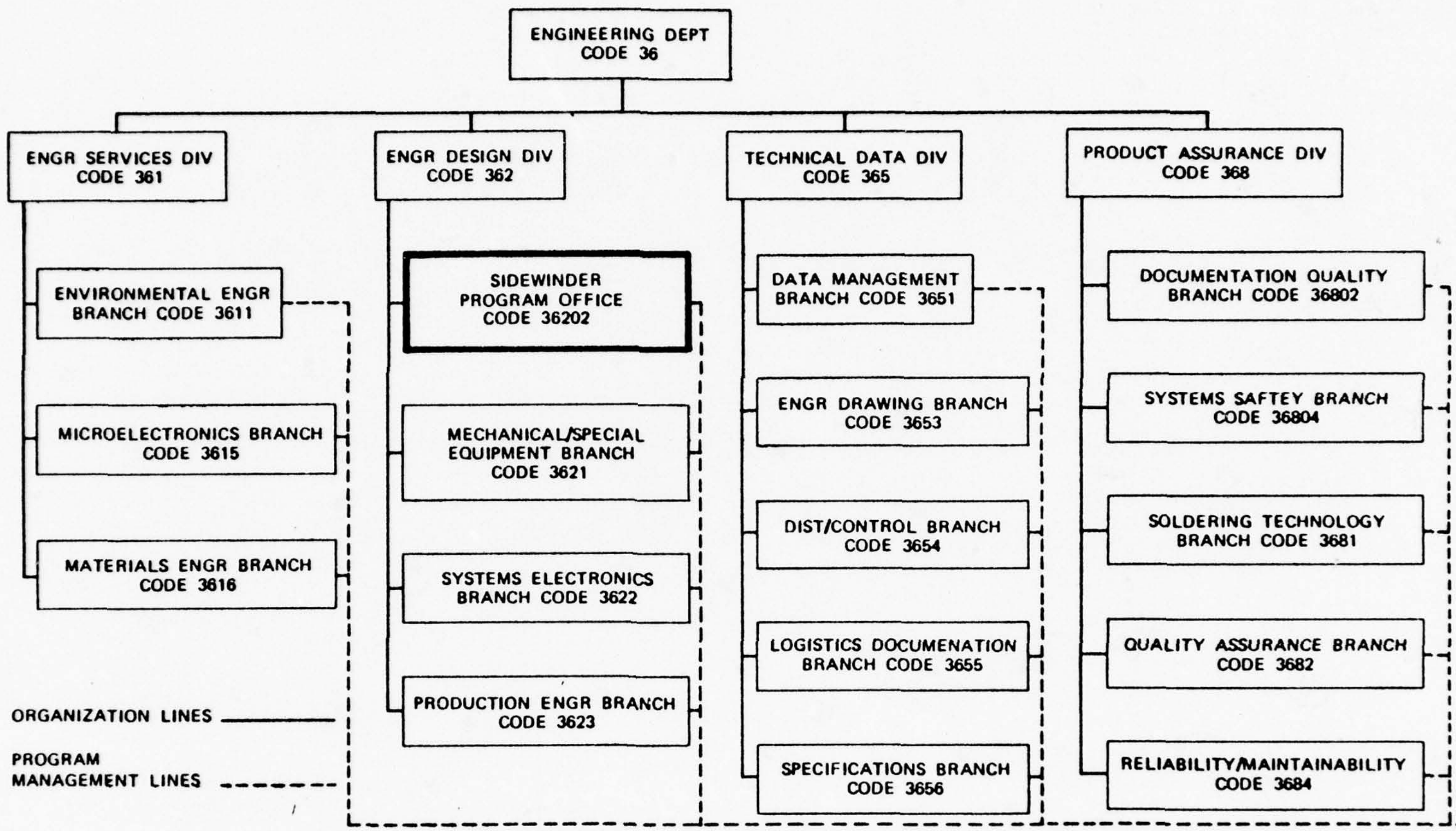
# APPENDIX C
# NWC ORGANIZATION



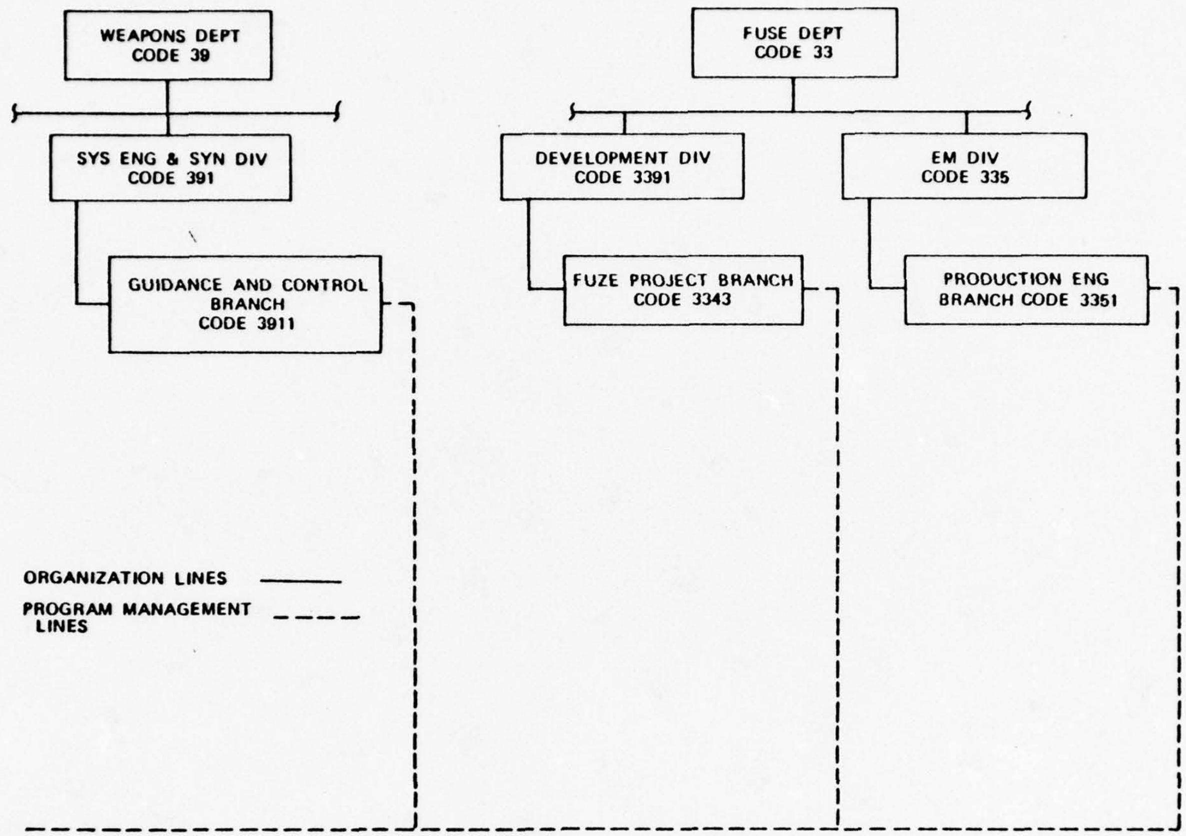
## APPENDIX D
## ENGINEERING DEPARTMENT ORGANIZATION



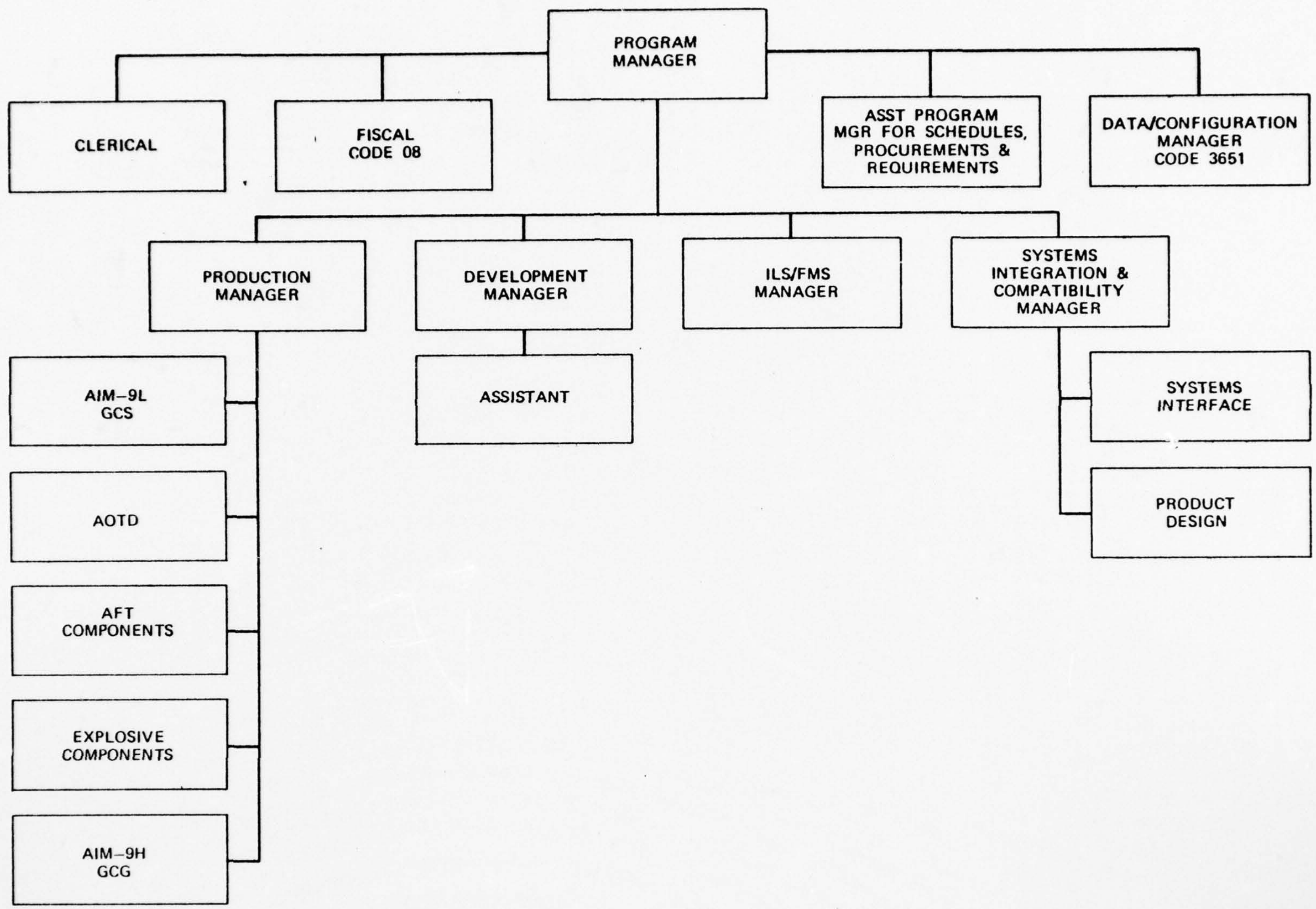
## APPENDIX E
## SPO/NWC – NWC FUNCTIONAL ORGANIZATION INTERFACES



## APPENDIX E
## SPO/NWC – NWC FUNCTIONAL ORGANIZATION INTERFACES (CONTD.)



# APPENDIX F
## SIDEWINDER PROGRAM OFFICE (NWC)



## APPENDIX G
## SPO/NWC–PFA INTERFACES

SIDEWINDER PROGRAM OFFICER
CODE 36202
NAVAL WEAPONS CENTER
CHINA LAKE

| | |
|---|---|
| PACIFIC MISSILE TEST CENTER PT. MUGU, CA. | – ECP LOGISTIC IMPACT |
| FLEET ANALYSIS CENTER CORONA, CA. | – TEST EQUIPMENT CERTIFICATION |
| NAVAL ORDNANCE STATION INDIAN HEAD, MD. | – ROCKET MOTOR TECHNICAL SUPPORT |
| EGLIN AIR FORCE BASE FT. WALTON BEACH, FL. | – AIR FORCE TECHNICAL REQUIREMENTS |
| NAVY GAUGE AND STANDARDS LAB POMONA, CA. | – GAUGES |
| NAVAL WEAPONS SUPPORT CENTER CRANE, IN. | – WARHEAD SUPPORT/MANUFACTURER |
| OGDEN AIR LOGISTICS COMMAND OGDEN, UTAH | – IN–SERVICE MISSILE AND UTILIZATION DATA |
| AIR FORCE TEST AND EVALUATION CENTER, KIRTLAND, N.M. | – TEST SUPPORT |
| NAVAL ORDNANCE LABORATORY LOUISVILLE | – CONTAINER PROCUREMENT |
| NAVAL WEAPONS LABORATORY DAHLGREN | – ELECTROMAGNETIC REQUIREMENTS AND TEST |

## APPENDIX H
## SPO/NWC – SIDEWINDER COMPONENT CONTRACTORS INTERFACES

SIDEWINDER PROGRAM OFFICE
CODE 36202

| | |
|---|---|
| RAYTHEON COMPANY | – GUIDANCE & CONTROL SECTION |
| AERONUTRONICS–FORD | – GUIDANCE & CONTROL SECTION |
| SANTA BARBARA RESEARCH CENTER | – FUSE |
| MARTIN MARIETTA | – FUSE |
| ROCKETDYNE | – MOTOR |
| BERMITE | – MOTOR |
| MICRONICS | – SAFETY AND ARMING DEVICE |
| ERI | – WINGS |
| CRANE–NAVAL WEAPONS SUPPORT CENTER | – WARHEAD |
| LOCKLEY MFG COMPANY | – FIN |

# Appendix I

AIRTASK/WORK UNIT ASSIGNMENT
NAVAIR FORM 3930/1 (REV. 9-69)

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
WASHINGTON, D.C. 20360

See NAVAIR 3900.8 or supersedure for applicable details on completing this form.



| | | | |
|---|---|---|---|
| CLASSIFICATION: UNCLASSIFIED | | | |
| ADDRESSEE: Commander (Code 55202) Naval Weapons Center China Lake, CA 93555 | | AIRTASK NO.: A05P-204/2162/6000/00000 | AMEND. NO.: Ø |
| | | WORK UNIT NO.: | AMEND. NO.: |
| | | EFFORT LEVEL: Normal | |
| NAVAIR PROJECT ENGINEER: W. Groome, Jr. | CODE: AIR-05P/ ESA-2041 | CLASSIFICATION OF AT/WU: UNCLASSIFIED | |

1. The AIRTASK/WORK ~~UNIT ASSIGNMENT~~ described below is assigned in accordance with the indicated effort level and schedule: Funding authorization for AIRTASKS will be provided in separate correspondence. If this AIRTASK~~/WORK UNIT ASSIGNMENT~~ cannot be accomplished as assigned, advise the Commander, Naval Air Systems Command, and the NAVAIRSYSCOM T&E COORDINATOR, if applicable.

No work beyond the planning phase will be accomplished unless the addressees have funds in hand or written assurance thereof.

2. CANCELLATION, REFERENCES, AND/OR ENCLOSURES:

3. TECHNICAL INSTRUCTIONS:

a. Title: Production Support of Air Launched Guided Missile Weapon Systems.

b. Purpose: The purpose of this AIRTASK is to assign to the NAVWPNCEN, China Lake the production support responsibilities for Air Launched Guided Missile Weapon Systems as set forth herein.

c. Background: The policy of the Naval Air Systems Command (AIR-05P/ESA-20) is to delegate to specified field activities certain functions required in support of the production of ALGM (Air Launched Guided Missiles). The assignment of Production Support to specified field activities will further consolidate engineering functions and provide optimum interface between Basic Design Engineering, Integrated Logistics Support, Maintenance Engineering and Production Support.

d. Detailed Requirements: Under this AIRTASK NAVWPNCEN China Lake shall support NAVAIR by performing assigned tasks as directed by NAVAIR (AIR-05P/ESA-20) in work assignments issued relative to Data Management Support, Configuration Management Support, Product Assurance Support, and Administrative Support.

SIGNATURE (By Direction COMNAVAIR): W. J. Hughes
W. J. HUGHES, BY DIRECTION
ORGANIZATION AND CODE MARKING

DATE: 9/15/75

(1) Data Management Support:

(a) Coordinate review and up-dating of data so as to provide current data packages for reprocurement of assigned systems, related equipment or elements thereof.

(b) Assist NAVAIR (AIR-05P/ESA-204) in definition of data requirements as required.

(2) Configuration Management Support:

(a) Coordinate configuration mangement (identification control, and status accounting) efforts so as to provide current product baselines and configuration traceability for assigned systems related equipment or elements thereof.

(b) Review for system impact and submission to NAVAIR of recommendations concerning Class I ECP and critical/major waiver and deviation requests.

(c) Review for system impact of Class II ECP and minor waiver and deviation requests. Technical approval of Class II ECP and minor waiver and deviation requests when specified by the production contract.

(d) As required, conduct configuration audits.

(3) Product Assurance Support:

(a) Participate in pre- and post-award surveys, quality audits, contractor/contracting officer technical meetings and facility conferences as required.

(b) Conduct GLAT (Government Lot Acceptance Testing) or provide technical support therefor, as required.

(c) Perform comparative trend analysis of production test data, field test data, and performance data to evaluate system performance, quality, and reliability. Adverse trends and recommendations for corrective action shall be reported to NAVAIR (AIR-05P/ESA-204) immediately.

(d) Review production specifications, assembly and test instructions, quality assurance procedures, and reliability requirements for assigned systems to determine correlation of assembly, test, quality and reliability requirements during production, assembly and test and delivery of the RFI round to inventory.

(e) Coordinate quality and reliability efforts to assure compatibility of such efforts with system requirements.

(f) Provide test equipment certification and correlation for each assigned system.

(g) Maintain management reporting systems as established at FMSAEG (Fleet Missile Systems Analysis and Evaluation Group) (Code 25).

(4) Administrative Support:

(a) Coordinate PFA (Participating Field Activities) production support budget requests so as to submit to NAVAIR (AIR-05P/ESA-204) one (1) production support budget requirement for each assigned system.

(b) Submit to NAVAIR (AIR-05P/ESA-204) for each assigned system a quarterly report containing funds and manhours expended for each of the support areas contained in this AIRTASK and allowing traceability to the PFA level by work unit assignment number.

4. SCHEDULE:

This is a continuing AIRTASK assignment. Effective date is 12 Sep 1975.

5. REPORTS AND DOCUMENTATION:

a. Reports: Reporting and documentation requirements will be defined in the individual WORK UNIT ASSIGNMENTS established under this AIRTASK.

6. CONTRACTUAL AND WORK AUTHORIZATION AUTHORITY:

Contracts with industry and work authorization to PFA's (Participating Field Activities) to perform portions of this AIRTASK are hereby authorized within the limit of funds made available.

7. SOURCE AND DISPOSITION OF EQUIPMENT:

This AIRTASK includes the authority to dispose of equipment acquired by NAVWPNCEN China Lake or assigned by NAVAIR for use in connection with this AIRTASK, unless otherwise specified at the time of its assignment.

8. AIRCRAFT REQUIREMENTS:

Requirements for testing (PMT) involving aircraft shall be achieved through normal channels at NAVWPNCEN, China Lake.

9. COST ESTIMATE:

Funding will be estimated and allocated by individual WORK UNIT ASSIGNMENTS.

10. STATUS OF APPLICABLE FUNDS:

Funding for this AIRTASK will be provided by separate correspondence.

11. SECURITY REQUIREMENTS:

The security clearances of personnel working on projects under this AIRTASK and the security classifications on documentation and hardware associated with this AIRTASK shall be commensurate with the classification of that hardware or documentation as determined from the applicabel security regulations.

Copy to:
Addressee ( 5)
PACMISTESTCEN, Pt Mugu
NAVAVIONICFAC, INDIANAPOLIS
NAVAIRDEVCEN, Warminister, PA
"SWC, Dahlgren
.ISAEG ANX, Corona

AIRTASK/WORK UNIT ASSIGNMENT
NAVAIR FORM 3930/1 (REV. 9-69)

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
WASHINGTON, D.C. 20360

See NAVAIR 3900.8 or supersedure for applicable details on completing this form.

CLASSIFICATION
UNCLASSIFIED



| ADDRESSEE | AIRTASK NO. | AMEND. NO. |
|---|---|---|
| Commander (Code 55202)<br>Naval Weapons Center<br>China Lake, CA 93555 | A05P-204/2162/6000/00000 | 1 |
| | WORK UNIT NO.<br>N/A | AMEND. NO. |
| | EFFORT LEVEL<br>NORMAL | |
| NAVAIR PROJECT ENGINEER<br>W. GROOME, JR. — CODE AIR-05P/ ESA-2041 | CLASSIFICATION OF AT/WU<br>UNCLASSIFIED | |

1. The AIRTASK/~~WORK UNIT ASSIGNMENT~~ described below is assigned in accordance with the indicated effort level and schedule. Funding authorization for AIRTASKS will be provided in separate correspondence. If this AIRTASK/~~WORK UNIT ASSIGNMENT~~ cannot be accomplished as assigned, advise the Commander, Naval Air Systems Command, and the NAVAIRSYSCOM T&E COORDINATOR, if applicable.

Request that the following changes be made to this AIRTASK:

a. Change paragraph 3.d.(3) to read:

(3) Product Assurance Support: (See Note 1)

b. Add Note 1 as follows:

Note 1. All efforts expended in support of Product Quality Assurance will be at the direction of AIR-05P/ESA-4 and as specified by Work Unit Assignments issued by same against this AIRTASK.

c. Amend paragraph 8. to read "Not applicable."

Copy to:
Addressee (5)
PMA-259
AIR-05P/ESA-4
AIR-05P/ESA-2041D

SIGNATURE (By Direction COMNAVAIR)
W. J. Hughes

DATE
9/30/75

CLASSIFICATION AND GROUP MARKING



Previous issues of this form are obsolete.

Appendix I

AIRTASK/WORK UNIT ASSIGNMENT
NAVAIR FORM 3930/1 (REV. 9-69)

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
WASHINGTON, D.C. 20360

See NAVAIR 3900.8 or supersedure for applicable details on completing this form.

CLASSIFICATION
UNCLASSIFIED



| | |
|---|---|
| ADDRESSEE<br>Commander<br>Naval Weapons Center<br>(Code 55202)<br>China Lake, CA 93555 | AIRTASK NO. / AMEND. NO.<br>WORK UNIT NO.: ESA-204/AIM-9L/01 — AMEND. NO.: Ø<br>EFFORT LEVEL: Normal |
| NAVAIR PROJECT ENGINEER / CODE | CLASSIFICATION OF AT/WU: Unclassified |

1. The AIRTASK/WORK UNIT ASSIGNMENT described below is assigned in accordance with the indicated effort level and schedule. Funding authorization for AIRTASKS will be provided in separate correspondence. If this AIRTASK/WORK UNIT ASSIGNMENT cannot be accomplished as assigned, advise the Commander, Naval Air Systems Command, and the NAVAIRSYSCOM T&E COORDINATOR, if applicable.

2. Cancellation, References and/or Enclosures.

Ref: AIRTASK A05P-204/2162/6000/000000

3. Technical Instruction.

a. Title. AIM-9L In-House Systems Engineering and Production Support Activities.

b. Purpose. To define the production support services to be furnished by Naval Weapons Center (NAVWPNCEN) to the Naval Air Systems Command (NAVAIRSYSCOM) and the Naval Weapons Engineering Support Activity (NWESA) for the procurement of the AIM-9L SIDEWINDER Missile System.

c. Background Information. The NAVWPNCEN has been providing production support on the AIM-9H SIDEWINDER missile under the provisions of the referenced AIRTASK and Work Unit Assignment No. A05P-204/AIM-9H/11.

d. Detailed Requirements. At the direction and/or with advance concurrence of ESA-204, provide the following production support activities:

(1) Program Support

(a) As directed by ESA-204, assist in the preparation of procurement requests (PR's), requests for proposals/quotations (RFP's/RFQ's) and contract negotiations to assure the continuity of program elements.

(b) Assist ESA-204 in the resolution of production problems.

(c) Assist ESA-204 in the resolution of weapon system interface problems, i.e., test equipment, avionics, logistics, and support equipment (NARF and NWS).

(d) Participate in Program Review Meetings.

37A 11-18-76 KB

| SIGNATURE (By Direction COMNAVAIR) | DATE |
|---|---|
| [signature] | 11/3/76 |
| CLASSIFICATION AND GROUP MARKING | |



Previous issues of this form are obsolete.

(2) Product Assurance Support

(a) Review, analyze and evaluate program reliability and maintainability requirements, performance, and demonstrations.

(b) Assist ESA-204 in the preparation of specifications and other documentation or presentations as required.

(c) Review, analyze and evaluate product assurance program requirements, performance and demonstration.

(3) Data Management Support

Collate, review, and validate all approved changes on the AIM-9L data package. Ensure that the data is updated prior to releasing for production procurement.

(4) Configuration Management

(a) Evaluate engineering change proposals by performing tests on hardware in the NAVWPNCEN laboratories or in contractor's facilities, as required.

(b) Establish production baselines, a master documentation control center, and configuration management practices.

(c) Monitor contractor compliance with the product baseline list and other contractual requirements (e.g., reliability, maintainability, etc.) and provide such other assistance to the Contractor to resolve production problems, specification compatibility problems, and any other problems affecting production.

e. Detailed Program Plan. N/A

4. Schedule.

This is a continuing Work Unit Assignment.

5. Reports and Documentation.

a. Submit to ESA-204 a quarterly report containing funds and manhours expended for each of the support areas contained in this Work Unit Assignment and allowing traceability by Work Unit Assignment Number.

b. Provide ESA-204 with any suggested update, change or additional requirements to the current Work Unit Assignment, which is desired for the next years effort. The revised Work Unit Assignment will become the basic document for budget submissions and is required prior to 1 June.

c. Correspondence relating to this Work Unit Assignment shall be routed through ESA-204 or as directed by ESA-204.

6. Contractual Authority.

See AIRTASK.

7. Source and Disposition of Equipment.

See AIRTASK.

8. Aircraft Requirements.

See AIRTASK.

9. Cost Estimates.

To be supplied under separate transmittal.

10. Status of Applicable Funds.

Funds will be provided by separate correspondence.

11. Security Classification Requirements.

See AIRTASK.

Copy to:
NWC 55202 (5)
PMA-259
ESA-2012A
ESA-2041D
AIR-5105B

Appendix J.

INFORMATION FLOW RAW DATA

INCOMING MESSAGES

| | |
|---|---|
| NAVMAG | 2 |
| AAFB. | 2 |
| Pt.Mugu | 58 |
| USS.MIDWAY | 3 |
| NARF. | 4 |
| Kirtland AFB. | 5 |
| CHNAVPERS. | 1 |
| Aero Ford | 10 |
| NASCREPLANT. | 8 |
| WPAFB. | 7 |
| CNO. | 13 |
| NSWC. | 3 |
| NASC. | 38 |
| NAV/I. | 1 |
| FAC/C. | 1 |
| NELLIS AFB. | 28 |
| MAG-15 | 2 |
| USS.KANSAS-CITY | 1 |
| Eglin AFB. | 10 |
| FLTAC. | 5 |
| USS.DOWNES | 1 |
| AAFB. | 1 |
| MICOM. | 1 |
| VX-4 | 2 |
| DCASD. | 2 |
| NESC. | 3 |
| SPCC. | 5 |
| CSAF. | 6 |
| NWSC. | 1 |
| FAIRWESTPAC. | 1 |
| CNAPA. | 8 |
| OPTEVFOR. | 1 |
| CNM. | 2 |
| IMMCO. | 1 |
| CNAVRES. | 2 |
| NASCREPAC. | 2 |
| NAVFITWPSCOL. | 2 |
| NWS/Y. | 1 |
| MAG-31 | 2 |
| NAVAIRLANT | 5 |
| USDAO/S. | 1 |
| CTF/77 | 1 |
| NAD/H. | 1 |
| MMMU-1 | 3 |
| CTG77Pt.4 | 2 |
| FITRON-32 | 1 |
| NADC. | 1 |
| MAG-12 | 1 |
| NWESA. | 10 |
| EDWARDS AFB. | 1 |
| MDAC. | 1 |
| WRAFB. | 1 |
| CINCPACFLT | 5 |
| DCRAVSCOM. | 1 |
| RAFB. | 1 |
| Raytheon | 2 |
| NFWS | 1 |
| NATC. | 1 |
| PMTC/Y. | 1 |
| NWS/C. | 6 |
| *GenDynamics* | 1 |
| NOS/I. | 1 |
| HAC. | 1 |
| JCS. | 1 |
| NTEC. | 1 |
| CMC | 2 |
| FMFPAC. | 1 |
| FITAEWWINGPAC. | 3 |
| USS.RANGER | 1 |
| ATKRON-174 | 1 |
| MAG-B. | 1 |
| SECNAV. | 1 |
| NAVAIRPAC. | 1 |
| LABF. | 1 |
| NAS/M. | 1 |
| CINCLANTFLT | 1 |
| NFWS | 1 |

TOTAL 313

## INCOMING LETTERS AND SPEEDLETTERS TO CODE 36202

**From Navy Facilities:**

| | |
|---|---|
| NASC | 116 |
| NMC | 4 |
| NAF/I | 4 |
| NSWC/D | 1 |
| NWSC/C | 10 |
| CNO | 3 |
| SPCC | 8 |
| NOS/I | 8 |
| Pt. Mugu | 55 |
| NWS/Y | 3 |
| NWS/C | 7 |
| NWESA | 27 |
| NWS/SB | 42 |
| NAF/PF | 2 |
| NAS/NI | 1 |
| OPTEVFOUR | 2 |
| NRL | 1 |
| NEODF | 1 |
| NETPDC | 1 |
| USS/KC | 1 |
| CVW-5 | 1 |
| OCMM | 1 |

**From Army Facilities:**

| | |
|---|---|
| MICOM | 2 |

**From Air Force Facilities:**

| | |
|---|---|
| EDWARDS | 1 |
| EGLIN | 11 |
| WPAFB | 8 |
| WRAFB | 3 |
| KIRTLAND | 2 |
| NELLIS | 1 |

**Defense Supply Agency:**

| | |
|---|---|
| DCASD/SA | 87 |

**FEDERAL REPUBLIC OF GERMANY**

| | |
|---|---|
| GMBH | 4 |

**Contractors:**

| | |
|---|---|
| HAC | 1 |
| GD | 1 |
| BENDIX | 1 |
| SBRC | 94 |
| MC DONNELL | 4 |
| LMCI | 6 |
| NORTHROP | 1 |
| AEROFORD | 158 |
| GAC | 3 |
| DCASO/RC | 26 |
| RAYTHEON | 113 |
| SCI | 25 |
| EKC | 1 |
| BERMITE | 21 |
| APCI | 1 |
| ADCA | 2 |
| LOCKHEED | 1 |
| ROCKEDYNE | 17 |
| MICRONICS | 45 |
| OLIN | 3 |
| TOLEX WEST | 1 |
| DYNAMICS RESEARCH | 1 |
| JUDSON | 1 |

FROM Code-36202

**TO: Ser. Letters**

| | |
|---|---|
| Raytheon | 4 |
| NASC. | 57 |
| Aero Ford | 9 |
| PMTC/Pt.Mugu | 8 |
| DCASO/RC. | 11 |
| DCASD/SA. | 51 |
| DCASR. | 1 |
| SPCC. | 3 |
| Eglin AFB. | 4 |
| Kirtland AFB. | 1 |
| Santa Barbara Research Center | 7 |
| Wright Patterson AFB. | 2 |
| Nellis AFB. | 2 |
| Warner Robbins AFB. | 1 |
| IDASTD. | 1 |
| ADTC. | 1 |
| NWSC. | 1 |
| McDonnell Douglas Corp. | 1 |
| General Dynamics | 1 |
| JRMC. | 1 |
| NRL. | 1 |
| ODD/T&E. | 1 |
| TOTAL | 168 |

**Serialized Transmittals**

| | |
|---|---|
| Raytheon | 23 |
| NASC. | 19 |
| Aero Ford | 10 |
| PMTC/Pt.Mugu | 6 |
| DCASO/RC. | 1 |
| Eglin AFB. | 8 |
| Chief of Staff AF. | 1 |
| Grumman. | 4 |
| Kirtland AFB. | 16 |
| Santa Barbara Research Center | 1 |
| Federal Republic of Germany | 3 |
| Wright Patterson AFB. | 6 |
| Nellis AFB. | 3 |
| NPGS. | 2 |
| NATC. | 1 |
| OPTEVFOR. | 1 |
| NRL. | 2 |
| NARF. | 1 |
| GE. | 1 |
| NAEC. | 1 |
| GEC. | 1 |
| TOTAL | 111 |

OUTGOING MESSAGES

| | | | |
|---|---|---|---|
| NASC. | 15 | NAFI. | 1 |
| MAG-31 | 1 | MDC. | 1 |
| PMTC/Pt.Mugu | 3 | RC. | 1 |
| Gen.Dynamics | 3 | NELLIS AFB. | 2 |
| MAG-15 | 1 | CINCLANTFLT. | 1 |
| Aero Ford | 4 | NSWC. | 1 |
| MAG-24 | 3 | NAVMAG. | 1 |
| Uss.Midway | 1 | NWESA. | 1 |
| WPAFB. | 5 | NESC. | 1 |
| DCASO | 1 | | |
| DCASR | 1 | | |
| NOS/I. | 2 | | |
| VX-4 | 2 | | |
| CNO. | 2 | | |
| SPCC. | 2 | | |
| CNM. | 1 | | |
| NAS/N. | 1 | | |
| Kirtland AFB. | 2 | | |
| FLTAC. | 1 | TOTAL | 61 |

Appendix K

| TASK AGREEMENT - INTERDEPARTMENTAL 11ND-NWC-3920/19 (1-76) PART 1 | TASK NO. D-19-76 | AMENDMENT | DATE | PAGE 1 of 2 |
|---|---|---|---|---|

PROGRAM

AIM-9L PRODUCTION SUPPORT

| COG CODE | COGNIZANT DEPARTMENT CONTACT | PERF CODE | PERFORMING ENGINEER/MANAGER |
|---|---|---|---|
| 36202 | R. W. Doucette | 3662 | T. W. Hampton |
| COG DIV | DIVISION HEAD SIGNATURE | PERF DIV | DIVISION HEAD SIGNATURE |
| 362 | | 366 | |

| TASK TITLE | CHARGE NO. |
|---|---|
| AIM-9L PRODUCTION ENGINEERING/MONITORING FOR AFT COMPONENTS | 136720 * |

DESCRIPTION OF WORK REQUIRED:

Provide technical monitoring and production support of the AIM-9L procurement program for rocket motors, warheads, safety-arming devices, wings fins and coupling rings.
Responsibilities include data, configuration and product assurance support to NAVAIR, the Sidewinder Program Office, prime contractors and subcontractors.

APPROACH TO BE TAKEN:

DATA SUPPORT: Generate, review and interpret baseline drawings and specifications. Review and evaluate Engineering Change Proposals (ECPs), Specifications Change Notices (SCNs), Waivers and Deviations. Maintain documentation technical content accuracy.
CONFIGURATION SUPPORT: Perform necessary review to verify that production hardware matches the design equations. Resolve incompatabilities between hardware and design. Provide fabrication proceedures to contractors and assist in the resolution of production problems. Support Level-of-Effort contracts and propose design changes to improve producibility. Evaluate special designs and hardware modifications and estimate the cost impact of design changes including implementation and production costs.
PRODUCT ASSURANCE SUPPORT: Participate in pre- and post-award surveys, quality audits, contractor/contracting officer technical meetings and facilities conferences. Maintain facilities and perform quality assurance, acceptance qualification and failure analysis testing. Review and evaluate contractors production, test, handling and assembly procedures to improve producibility. Perform first article inspections and tear downs as required. Conduct failure mode studies to improve reliability. Perform design and certification of special test equipment for use during the production contract.

REPORTING:

Monthly reports in the format of enclosure (1) will be submitted to the Program Office no later than the 10th of the following month.

*FUNDING:

Applicable Job Orders:
- ACF — Safety and Arming Device
- ACG — Warhead
- ACH — Rocket Motor
- ACI — Wings and Fins

| TASK NO. | AMENDMENT | DATE | PAGE |
|---|---|---|---|
| | | | 2 OF 2 |

SCHEDULE:

ITEM:

This is a continuing task assignment.

| RESOURCE REQUIREMENTS (FUNDS) | | | | | |
|---|---|---|---|---|---|
| LABOR & OVERHEAD | MATERIALS | TRAVEL | CONTRACTS | TRANSFERS | TOTAL |
| FY 77 | | | | | |
| ACF 10 (.2) | | 2 | | | 12K |
| ACG 24 (.5) | | 0 | | | 24K |
| ACH 9 (.2) | | 2 | | | 11K |
| ACI 24 (.5) | | 2 | | | 26K |
| Total 67 (1.4) | | 6K | | | 73 ~~67~~K |

CRITICAL MANPOWER

| DISCIPLINE/NAME | NUMBER | MANHOURS | SCHEDULE ITEM |
|---|---|---|---|
| N/A | | | |

EXTRAORGANIZATIONAL FACILITIES, EQUIPMENT, SERVICES

| ITEM | SOURCE | AMOUNT | SCHEDULE |
|---|---|---|---|
| N/A | | | |

| COG DEPT MGR (INITIAL): | PERF DEPT MGR (INITIAL): |
|---|---|

SAMPLE MONTHLY REPORT

FROM (Reporting Code)

TO Sidewinder Program Office, Code 36202

SUBJ (month) Report of Sidewinder Tasks

1. Customer Order Title and No. (Sidewinder AIM-9L Production, 1367205)

   a. Job Order No. (ANA)

      (1) ACCOMPLISHMENTS

      Summary of:

      1) tests completed
      2) publications completed
      3) reports completed
      4) drawings completed
      5) significant correspondence
      6) significant events/break-thrus

      (2) PROBLEMS

      Summary of problems encountered.

      (3) TRAVEL

      Summary of travel including purpose and results.

      (4) VIP Visits

      Summary of visitors including purpose and results of visits.

   b. Job Order No. (ANB)

   (Same format as 1.a. above.)

2. Customer Order Title and No. (Sidewinder AIM-9H Production, 1367705

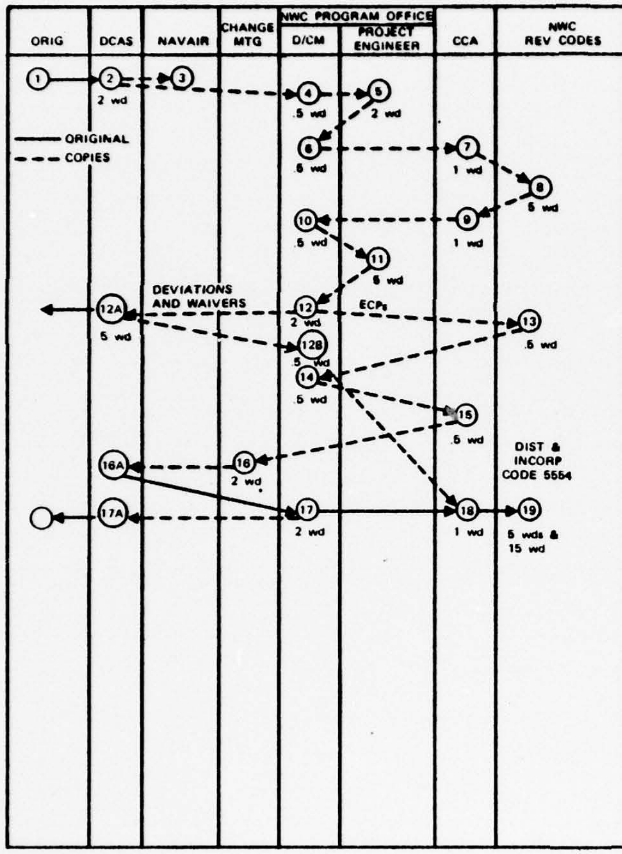
   (Same format as 1. above.)

(Reporting Official)

Enclosure (1)

# APPENDIX L

## CLASS II ECPs AND MINOR DEVIATIONS AND WAIVERS
## SIDEWINDER AIM-9H/L CHANGE LOW DIAGRAM (CONTRACTOR SUBMITTED)




**NOTES**

1 Contractor originates – forwards original to DCAS, copy(s) of ECPs with NORs to other contractor(s).

2 DCAS – for concurrence in classification – sends information copy to Navair and NWC Sidewinder Program Program Office – 2 working days.

3 NAVAIR – holds info copy pending NWC action.

4 Data/Configuration Manager (D/CM) reviews, logs in, attaches traveler and sends to Project Engineer. Retains copy – .5 working day (wd).

5 Project Engineer reviews for compatibility, feasibility and designates review codes on traveler. Returns to D/CM – 2 working days.

6 D/CM makes appropriate entries on ECP log and forwards to Configuration Control and Accounting (CCA) – .5 working day.

7 CCA logs receipt, distributes to review codes with traveler – 1 working day.

8 Review codes make technical review and indicate approval/disapproval and/or comments. Returns to CCA – 5 working days.

9 CCA logs action, compiles review package with comments and delivers to D/CM – 1 working day

10 D/CM logs action and forwards to Project Engineer – .5 working day.

11 Project Engineer reviews comments of review codes, resolves differences, recommends approval/disapproval, signs traveler, sends to D/CM – 5 working days.

12 D/CM makes appropriate entries on records and forwards ECPs to Documentation Quality Office (DQ), .5 working day. In the case of Deviations and Waivers, D/CM prepares letters and forwards to DCAS – 2 working days.

12A DCAS forwards copies of authenticated Deviations and Waivers to D/CM for processing. Masters are forwarded to Originating Contractor – 5 working days.

12B D/CM logs final action and forwards to CCA for Configuration Accounting record. .5 working day.

13 DQ reviews comments of review codes and Project Engineer signs traveler indicating technical concurrence/non-concurrence; sends to D/CM – .5 working day.

14 D/CM reviews DQ action, records, resolves differences with Project Engineer and forwards to CCA – .5 working day.

15 CCA prepares complete package including supporting documentation and holds for scheduling of coordination meeting – .5 working day. Maximum hold time is 90 days or accumulation of 15 ECPs, whichever occurs first.

16 Class II ECP Coordination Meeting – reviews technical recommendations, participants make final approval/disapproval recommendations or defers decision – 2 working days.

16A DCAS authenticates masters and forwards to D/CM during Class II Meeting if in attendance – 15 working days, if mailing is necessary.

17 D/CM makes appropriate entries on records, sends approved ECPs to CCA for processing, returns disapproved ECPs to DCAS. Sends letter giving results of meeting to PMA 259 with info to participants at coordination meeting – 2 working days.

17A DCAS makes final disposition on disapproved or deferred ECPs – forwards to originator for re-evaluation or cancellation.

Originator re-evaluates and resubmits or cancels.

18 CCA logs final action, makes appropriate entries on Master Configuration Listing; forwards masters to Reproduction and Distribution – 1 working day.

19 Reproduction and Distribution distributes copies of authenticated NORs. 5 working days. Incorporates changes into drawing masters and specification masters and distributes to appropriate activities. 15 working days.

DC/CM – DATA/CONFIGURATION MANAGER

CCA – CONFIGURATION CONTROL ACCOUNTING

DQ – DOCUMENTATION QUALITY OFFICE

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Naval Weapons Center Instruction 5450.6B, Organizational Data Preparation, 14 January 1976.

Rigo, J. T., "System Requirements Documentation," Data Processing Management, v. 4-01-01, Auerbach Publishers Inc., 1975.

Wilkinson, J. W., "Classifying Information Systems," Journal of Systems Management, v. 24, p. 28-31, April 1973.

## List of References


[1] Rigo, J. T., "System Requirements Documentation," Data Processing Management, v. 4-01-01, Auerbach Publishers, Inc., 1975.

[2] Anthony, R. N., Planning and Control Systems: A Framework for Analysis, p. 16-18, Harvard University Graduate School of Business Administration, 1965.

[3] Gorry, G. A. and Scott-Morton, M. S., "A Framework for Management Information Systems," Sloan Management Review, v. 13-1, p. 55-70, Fall 1971.

[4] Ackoff, R., "Management Misinformation Systems," Management Science, v. 11-4, p. B147-B156, December 1967.

[5] Burch, J. G. and Strater, F. R., Information Systems: Theory and Practice, Hamilton, 1974.

[6] Wilkinson, J. W., "Classifying Information Systems," Journal of Systems Management, v. 24, p. 28-31, April 1973.

[7] Heany, D. F., Development of Information Systems, p. 45-143, The Ronald Press Company, 1968.

[8] Naval Weapons Center Instruction 3920.4, Policy Governing Management of Acquisition Programs, September 1976.

[9] Naval Weapons Center Instruction 5450.6B, Organizational Data Preparation, 14 January 1976.

[10] Koontz, H. and O'Donnell, C., Principles of Management, p. 640, McGraw Hill Book Company, 1968.

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